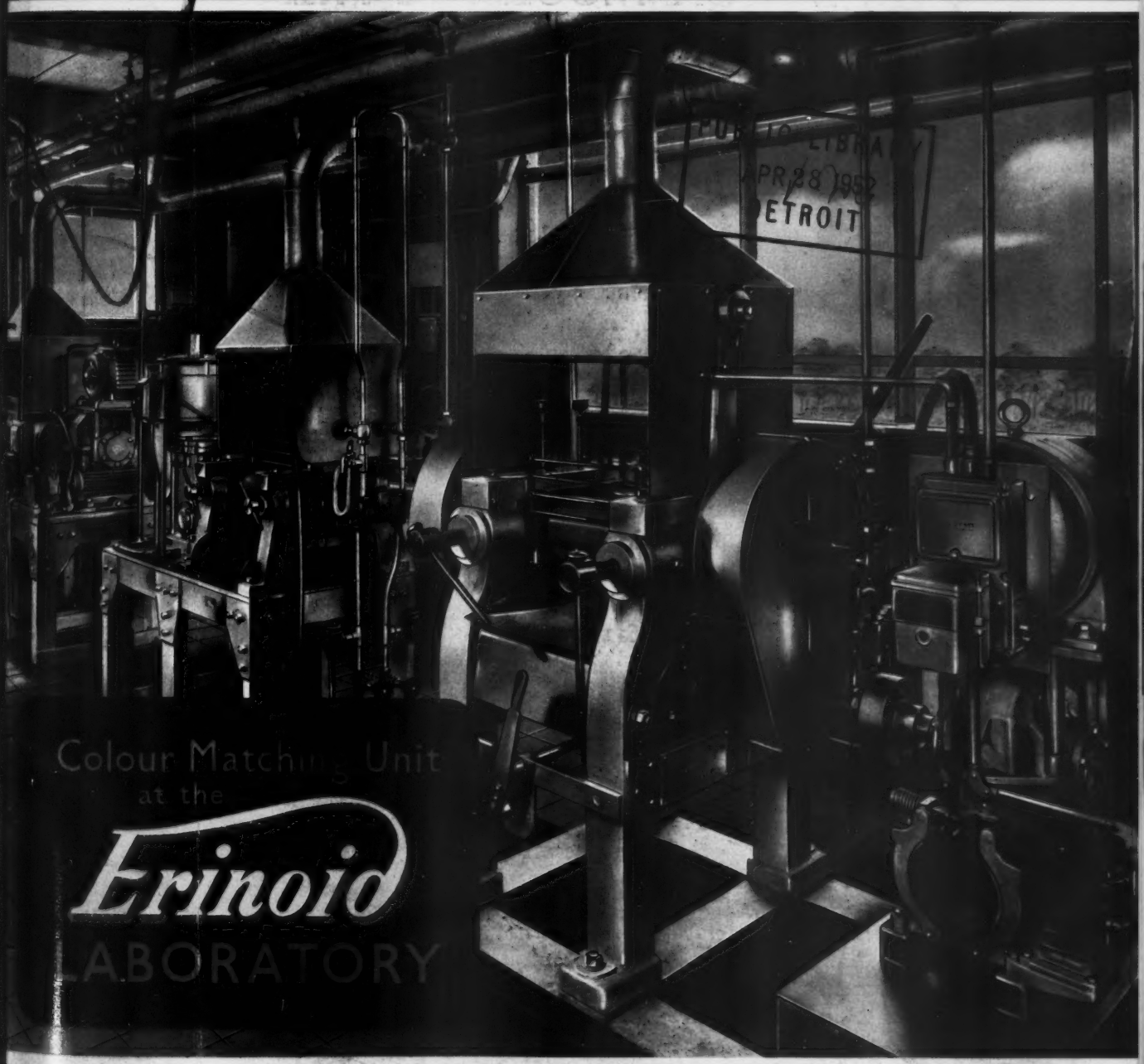
Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS



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APR 28 1952
DETROIT

ERINOID LIMITED · STROUD · GLOUCESTERSHIRE

EARLY DELIVERY

Foucher

FRENCH INJECTION MOULDING PRESSES

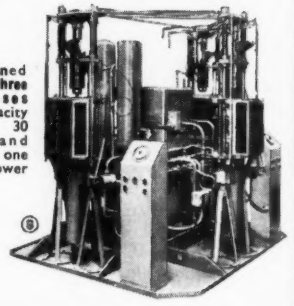
NOW AVAILABLE IN U.K. AND OVERSEAS

Vertical Injection Press. Capacity (acetate) 50-60 grammes. Injection pressure 15 tons, clamping pressure 50 tons. Speed of output 2 to 5 mouldings per minute depending on type of moulding, with effective working area of 120 to 150 square cms. Mould closing independent from injection.

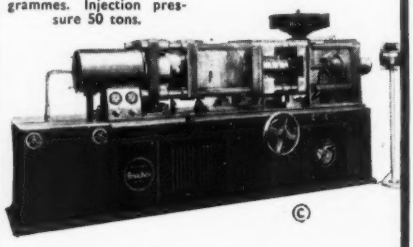
On the continent, these presses have already proved themselves to be of outstanding design for simplicity of operation and high rate of output.

The vertical presses have several unusual features, apart from the obvious space saving, which make them of particular interest to British manufacturers.

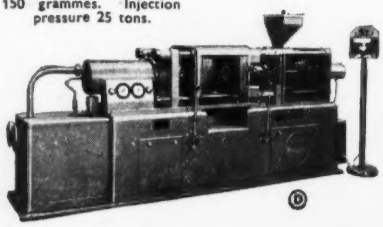
All four machines are now available for early delivery to the U.K. and overseas markets, and are supplied ready for immediate operation backed by an efficient spares service.



Self-contained battery of **three Vertical Presses** each with capacity (acetate) of 30 grammes and served by one hydraulic power unit.



Horizontal Injection Press. Capacity (acetate) 500 grammes. Injection pressure 50 tons.



Horizontal Injection Press. Capacity (acetate) 120 to 150 grammes. Injection pressure 25 tons.

Please write for descriptive literature to

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LAVINO (LONDON) LIMITED

[illegible] LANCASTER GATE, LONDON W.2. Telephone: [illegible] Telegrams: LAVINOLO, LONDON

"It's very easy"

says Mr. Bessant of Universal Tools.

. . . to see that this Uke wants more than just good mould making, it's an article that demands a better than usual finish, extreme accuracy in line up between four parts, all with vastly different shrinkage factors and, if you are going to produce a satisfactory instrument, an appreciation of the players' point of view.

It is a satisfactory instrument, and I believe it's the real interest in a customer's problems, backed by 100% craftsmanship and lots of experience that have enabled us to tool up so large a proportion of the outstanding mouldings you see around.

The foundation of successful plastic moulding lies in the mould.

The "Columbian" Ukulele is moulded by Thames Valley Moulders Ltd., for Selcol Products, Ltd.
The main moulding, nearly 21" long is produced on an 8-oz. PECO Injection Moulding Machine and is one of the four parts which go to make up the main body. The interior of the sound board and the fingerboard are scientifically ribbed to provide the essential strength and a further re-inforcement provides location for the steel springs on the friction grip tuning pegs. Experts agree that the instrument has the authentic Ukulele tone.

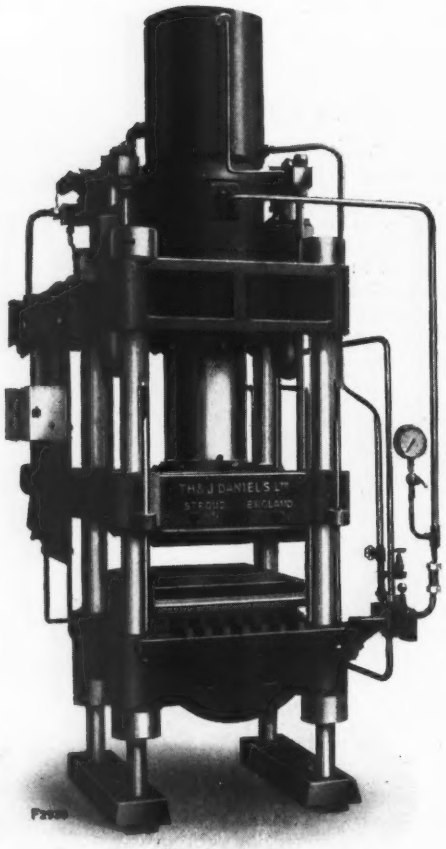
UNIVERSAL TOOLS LTD.

TRAMWAY PATH, MITCHAM, SURREY.

Telephone: MITCHAM 1624

DANIELS

EQUIPMENT FOR PLASTIC MOULDING



DANIELS 150-TON DOWNSTROKE PRESS

DOWNSTROKE PRESSES
UPSTROKE PRESSES
SIDE RAM PRESSES
PREFORMING MACHINES
HOBBING PRESSES
PREHEATING OVENS

T. H. & J. DANIELS LTD
STROUD, GLOS.

SOLE AGENTS FOR GREAT BRITAIN, FRANCE, INDIA & ITALY

ALFRED HERBERT LTD
FACTORED DIVISION · RED LANE · COVENTRY

British Industries Fair, Castle Bromwich
May 5th — 16th, 1952

We cordially invite you to visit our Stand where the exhibits include a **150-Ton Downstroke Press** and also the new **125-Ton Preforming Machine.**

The hydraulically-operated 150-Ton Press, similar to the accompanying illustration, is fitted with the Daniels Process Timer, which automatically controls the moulding cycle after the operator has loaded the material into the mould and closed the press.

A typical phenolic moulding will be produced from tablets produced on the **125-Ton Preforming Machine.**

The latter machine is hydraulically operated and exerts a maximum load of 125 tons on a 6" diameter tablet.

Although the production of circular tablets will be demonstrated, other shapes can be produced with equal facility providing they fit within a 6" diameter circle.

The machine is arranged for fully-automatic operation by means of a modified Daniels Process Timer.

Fabric filled materials can be handled if the filling is done manually, in which case operation is semi-automatic, the operator starting the machine at the beginning of each cycle.

STAND No. D.310

★ *This is one of a series of technical advertisements designed to advise Chemical Engineers and others of the extent of the Anti-Corrosion Service provided by DUNLOP. Other advertisements deal with soft rubber, ebonite, butyl, neoprene.*

ANTI-CORROSION *No. 4*

PLASTICISED POLYVINYL-CHLORIDE

Plasticised P.V.C.-lined tanks have been used successfully in chromium plating, fats splitting, wire pickling and copper plate engraving plants.

Plasticised P.V.C. linings have a superior resistance at temperatures up to 60° Centigrade to nitric, chromic, and hydrofluoric acids at concentrations for which rubber would not be suitable.

They withstand prolonged contact with plant liquors such as sodium hydroxide, and strong commercial hypochlorite, and are resistant to oxidation, water, sunlight, and gas diffusion. Dunlop standard gauge of Plasticised P.V.C. lining is $\frac{1}{16}$", this material economy being made possible by its exceptional resistance to corrosion. The tank-lining operation can be carried out at normal temperatures, so that in the event of unforeseen mechanical damage occurring, it can easily be repaired. The lining of chemical plant can be carried out at Dunlop factories, or on customers' own premises, subject to various limitations of plant design, facilities available and the type of protection required. Detailed service data should accompany all enquiries so that Dunlop technicians can advise accordingly.

Write today for Booklet:
"ANTI-CORROSION"

by **DUNLOP**

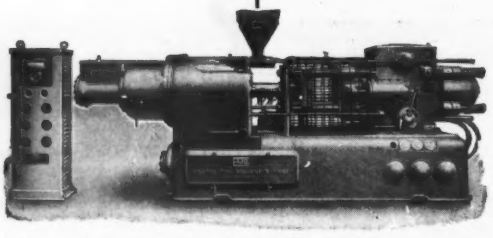
DUNLOP RUBBER CO. LTD. (GENERAL RUBBER GOODS DIVISION)
CAMBRIDGE STREET, MANCHESTER 1

Clerkenwell House, Clerkenwell Green, London, E.C.1 | Dunlop House, Livery Street, Birmingham 3 | Buckton's Chambers, 57 Meadow Road, Leeds 11 | Dunlop Rubber Co. (Scotland) Ltd., North Wallace Street, Glasgow, C.4

2G/GM6

BIF 1952
MAY 5-16
CASTLE BROMWICH
BIRMINGHAM
SEE OUR EXHIBIT
STAND D240

A simple pneumatically operated machine noted for its reliability and high rate of production.



E.M.B. PATENT No. 9B INJECTION MOULDER

We could show you some very interesting examples of pioneering problems we have helped to solve. The wide experience of injection moulding we have brought into the collaboration with customers, has produced results which put them far ahead of their competitors.

But we must keep faith and deny ourselves the publicity.

So if you have a novel development you would like to discuss with us, you may rest assured it will be treated confidentially if you so wish.

E.M.B. Co. Ltd.

WEST BROMWICH——————ENGLAND

Colours for Polystyrene

If you are using the dry colouring technique, or colouring Polystyrene by some other process, we suggest that you investigate the possibilities of our

UNIT PACKING

Each UNIT is sufficient to colour 50 lbs. of material to a given shade.

NEW OPAQUE SHADES

We are now able to offer a useful range of opaque shades, as listed in the right hand margin of this advertisement, and feel sure that they will readily find favour with users requiring this type of colour.

•

We shall be happy to send you full details of both our opaque and transparent ranges of colours on request.

Opaque Shades

Pollene	Green	OP3
„	Bright Red	OP21
„	Orange	OP23
„	Golden Yellow	OP24
„	Scarlet	OP25
„	Navy Blue	OP26
„	Yellow	OP29
„	Bottle Green	OP30
„	Carmine Red	OP31

Please address all enquiries to

ESTD. WH L 1877

'PHONE HOUnslow 1166 (7 lines)
'GRAMS. WILLIAMS. HOUNSLOW

Williams (HOUNSLOW) Ltd.
ANILINE DYE MANUFACTURERS

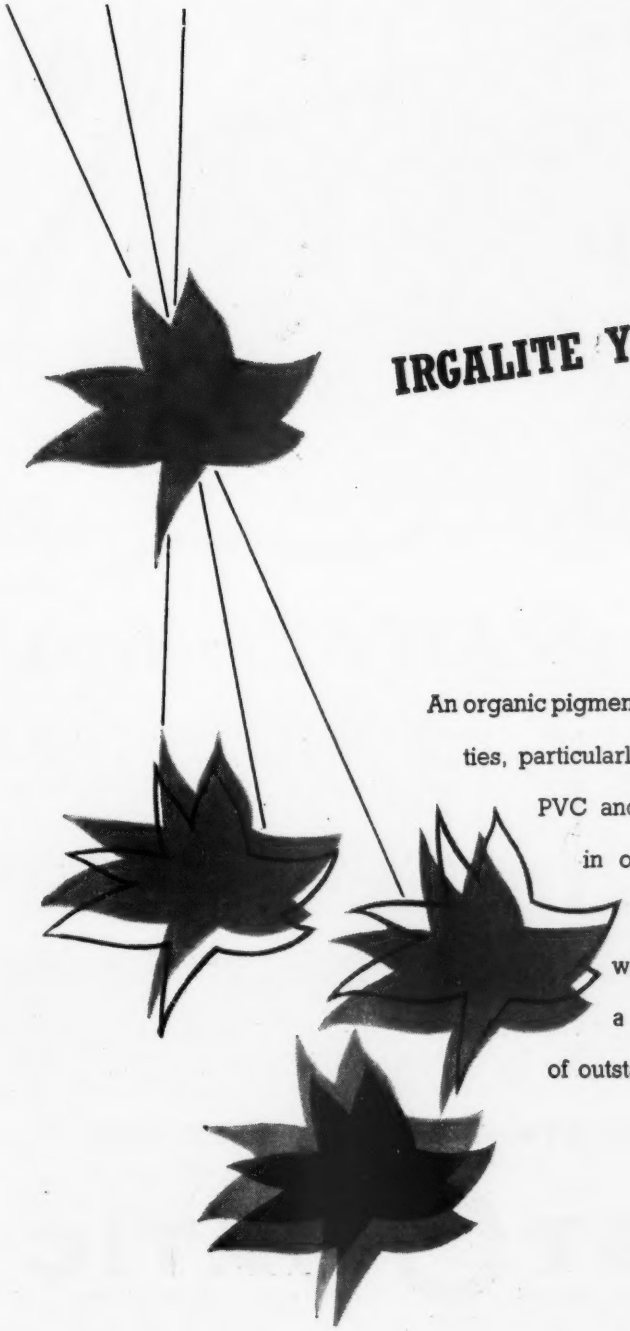
HOUNSLOW • MIDDLESEX

FIRTH BROWN

Special

PRIORITY & SERVICE

THOS. FIRTH & JOHN BROWN LTD., SHEFFIELD

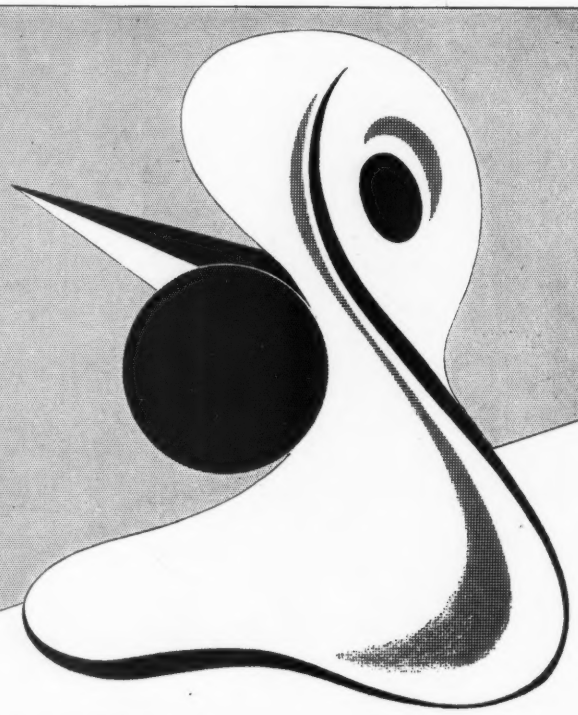


IRGALITE YELLOW WSC

An organic pigment of unique fastness properties, particularly recommended for use in PVC and rubber. Can be used in other plastics with equally good results. In admixture with suitable blues it produces a range of bright greens of outstanding fastness properties.

THE GEIGY COMPANY LTD., RHODES, MIDDLETON, MANCHESTER. P.21

if it can be moulded in plastics, we can do it . .



and in the RIGHT material

OPTICALLY CORRECT LENSES
PHOTOGRAPHIC APPLIANCES
PROJECTORS
ELECTRICAL COMPONENTS
ENGINEERING COMPONENTS
CAR ACCESSORIES
FANCY GOODS
TAP AND VALVE WASHERS
GAMES, TOYS, ETC.

(1) **THE PLASTOMATIC SERVICE** is at your disposal, and will mould and deliver at the stipulated times any quantities of an article already designed and tooled.

(2) **The Plastomatic Service** can undertake the design and tooling which will conform to the mechanical principles that ensure the very finest results in plastics.

(3) **The Plastomatic Service** guarantees that the right material will be used.

(4) **The Plastomatic Service** means exclusivity during the period of contract.

LET US QUOTE YOU FOR YOUR JOB

PLASTOMATIC LTD

Registered Trade Mark 641,685

MOULDERS OF PLASTIC MATERIALS TO THE TRADE

Members of The British Plastics Federation and on the official list of Contractors to H.M. Government.

17, WINCHESTER ROAD, HAMPSTEAD, LONDON, N.W.3 *Telephone : PRIMROSE 4463*

PL/1

BX PLASTICS LTD

at the B.I.F. Earls Court London

We cordially invite you to visit our Stand and see the full range of BX materials in the actual form in which they leave our factories for delivery to customers.

THE RANGE OF BX MATERIALS INCLUDES

XYLONITE (*Celluloid*)
BEXOID (*Cellulose Acetate*)
LACTOID (*The Casein Plastic*)
BX P.V.C. (*Polyvinyl Chloride*)
VELBEX (*P.V.C. Calendered Sheet*)
COBEX (*BX Copolymer*)
SARAN YARN (*Basis of "Tygan"*)
BX POLYSTYRENE
BX LAYFLAT POLYTHENE TUBE
ISOFLEX (*Lightweight Thermal Insulation*)
EXTRUSIONS (*In all materials for all purposes*)
BEXOL (*Solutions*)
BEXAN (*Synthetic Brush Filaments*)
BX FILM (*Celluloid, Cellulose Acetate & Triacetate*)

BULK CHEMICAL PRODUCTS

Detach and keep this page as a guide

BX PLASTICS LTD

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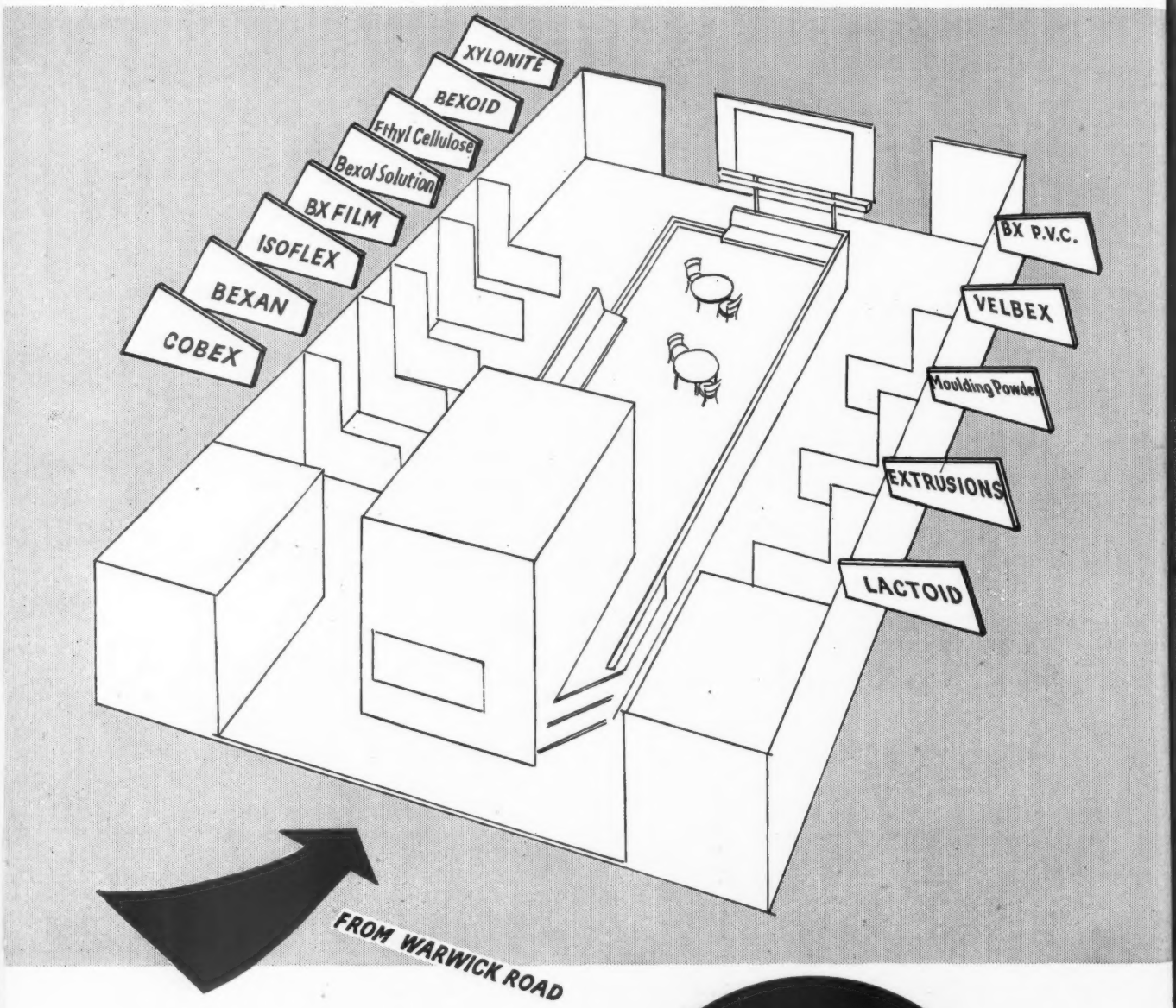

DISPLAYS SHOWING THE COMPLETE RANGE OF BX PLASTICS MATERIALS AND THEIR USES IN INDUSTRY

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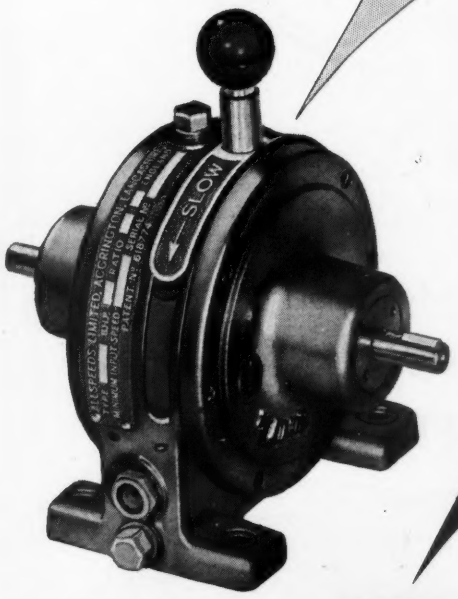
V2/11
1ST FLOOR
EARLS COURT
LONDON

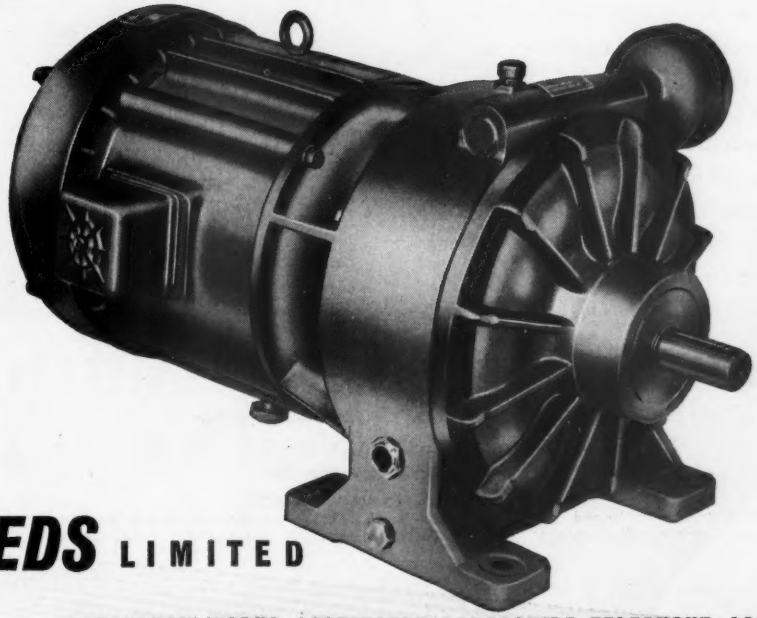
VISIT STAND No. D257

BIF
BIRMINGHAM



Kopp
VARIABLE SPEED GEAR

Kopp Variators are available from 1/4 to 6 B.H.P. with or without motors. All units are infinitely variable and give constant B.H.P. throughout the full speed range of 9-1



ALLSPEEDS LIMITED

OAKENSHAW WORKS, ACCRINGTON, LANCASHIRE. TELEPHONE: ACCRINGTON 3214

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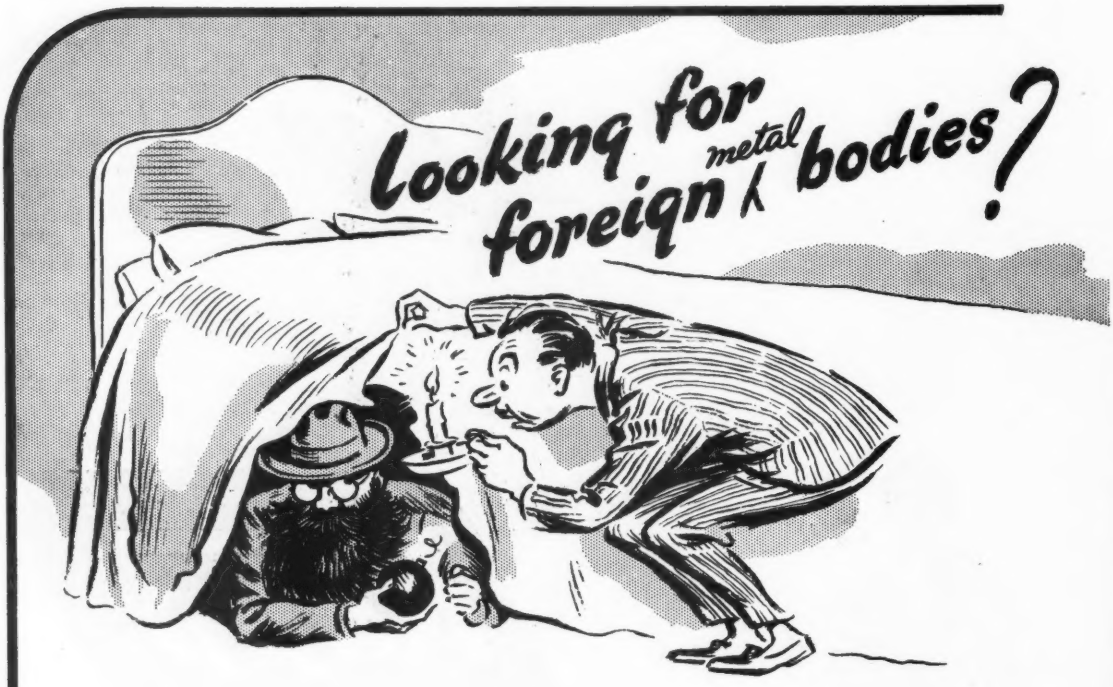
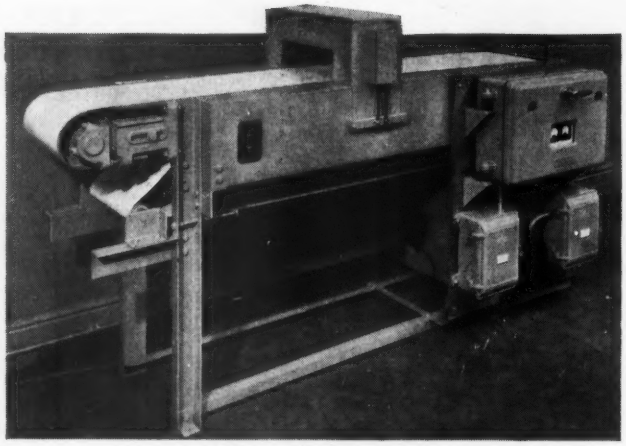


Then let this do the looking for you —

The New 'CINTEL' Industrial Electronic METAL DETECTOR

The presence of metallic foreign bodies in the plastic mix can cause havoc if they enter the calender. Such havoc can be avoided, however, by installing the 'CINTEL' METAL DETECTOR, an instrument that will detect any metal, ferrous or non-ferrous and give ample warning of its presence.

Full details are available, so why not write for them today?



CINEMA-TELEVISION LIMITED

A Company within the J. Arthur Rank Organisation

WORSLEY BRIDGE ROAD · LONDON · S E 26

Telephone: HITher Green 4600

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CINTEL

REGISTERED TRADE MARK

WHY USE CELLOMOLD FOR HACKSAW HANDLES?

BECAUSE it is the ideal moulding material for the job—so easy to use and admirably suited to large scale production! Examine the handle of this "Eclipse" hacksaw, produced by James Neill & Co. (Sheffield) Ltd., and you appreciate at once why Ashdowns Ltd. mould it in Cellomold cellulose acetate. It has strength, toughness, a fine appearance and is, moreover, warm to the touch. By choosing Cellomold, Ashdowns also secured an important saving in costs. For, besides being available in any colour and in a wide range of finishes and degrees of flow, Cellomold moulding materials are most economical in use. Please write, or telephone, for technical advice on your moulding problems and for a copy of the latest Cellomold Information Booklet.

BRP

BRITISH RESIN PRODUCTS LTD. *Sales & Technical Service: 21 St. James's Sq., London, S.W.1* *Telephone: Whitehall 8021-7*

"CELLOMOLD" IS A REGD. TRADE MARK

MELPLAS

MELWOOD
THERMOPLASTICS
LTD.
WILLOUGHBY ROAD
HARPENDEN · HERTS
Tel. HARPENDEN 300

Extruded Plastics
Rigid—and Flexible
will meet *all* your needs

STAND No. C.618, CASTLE BROMWICH

STABILISERS

for Polyvinyl Chloride and Vinyl Type Latices

Dispersed in plasticiser

Genuine English White Lead
Lead Stearate
Cadmium Stearate
Dibasic Lead Phosphite

Specially prepared and dispersed to give heat and light stability to P.V.C. and Vinyl Co-Polymers.

Dry

Calcium Stearate: *for use in P.V.C. as a combined lubricant/stabiliser. Frequently mixed with other stabilisers to provide maximum lubrication and stabilisation.*

ASSOCIATED LEAD MANUFACTURERS LIMITED

ASSOCIATED LEAD PRODUCTS

HOME AND OVERSEAS ENQUIRIES TO: SPECIAL CHEMICALS DIVISION, CRESCENT HOUSE, NEWCASTLE-UPON-TYNE, ENGLAND

FIX YOUR BONDING PROBLEMS

with

TITEBOND

A typical TITEBOND application: Plastic and Metal Trimmed Showcases, Counters, etc., in the store of the Dartford Co-operative Society Ltd. Photographs by courtesy of the Society and the Architects, Co-operative Planning, Ltd.

★ TITEBOND is the time-saving and labour-saving all-purpose bonding medium for the Plastics Industry. Based on one of the new synthetic rubbers, specially created and compounded, TITEBOND has outstanding adhesive qualities and gives very strong bonds. Its many invaluable qualities include flexibility to prevent cracking of materials, resistance to chemicals and solvents, and resistance to temperature variations. Can be easily applied by brushing, spraying or spreading. A TITEBOND bond is a bond for good.

TITEBOND *adhesive*

for bonding Plastics to Plastics, such as "FORMICA" (Regd.), Plastics to Metal, Metal to Metal, Glass to Fabric, Fabric to Wood, Fabric to Fabric, Leather to Leather, Leather to Paper, Paper to Metal, etc.

Write for full technical details and prices

SURRIDGE'S PATENTS LIMITED

NEW WORKS · CROYDON ROAD · ELMERS END · BECKENHAM · KENT

Telephone: Beckenham 0168

Ask Crystalate to quote for your job in Moulded Plastics

COMPRESSION
TRANSFER
AND
INJECTION
MOULDING

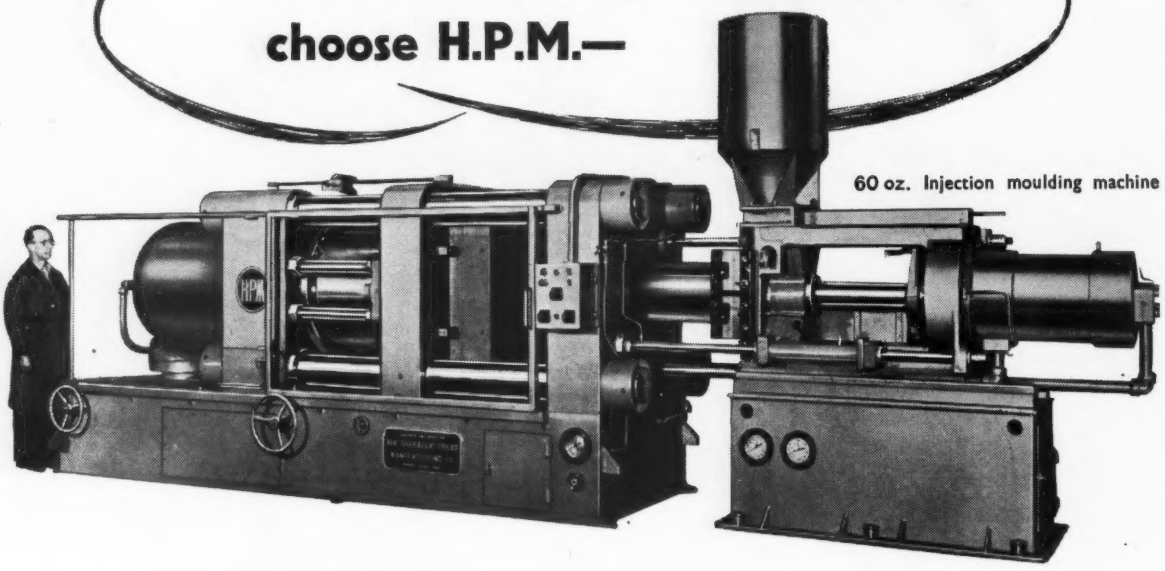
CRYSTALATE

AND—
TUBES
FABRICATIONS
MACHININGS
STAMPINGS

PLASTIC MOULDERS, FABRICATORS & TOOLMAKERS SINCE 1899

Crystalate Ltd., Crystalate House, Mill Lane, Tonbridge, Kent. *Phone : Tonbridge 2261/2/3/4/5.*

The leading "big" moulders choose H.P.M.—



60 oz. Injection moulding machine

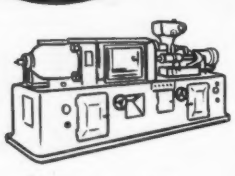
— and here's why

Injection moulders like the 60 oz. H.P.M. for big jobs . . . the power system is out in the open for easy accessibility . . . There's plenty of clamp pressure (1,000 tons) . . . big mould space (40″ x 60″) . . . lots of daylight (60″) . . . and enough stroke for those deep draw jobs (36″).

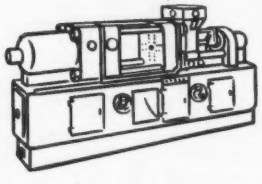
These big H.P.M.s are setting new records in rapid production of big refrigerator parts, radio and television cabinets, automobile mouldings, etc.—that's why so many have been installed.

Regardless of your moulding job, whether it requires a 9 or 60 oz. machine, investigate the many outstanding features of H.P.M.s all-hydraulic design; write for full details now.

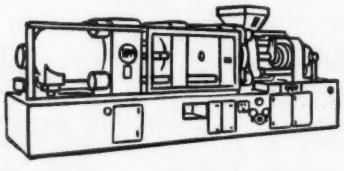
BRITISH HPM BUILT



9 OUNCE



16 OUNCE



32 OUNCE

Manufactured under licence by JOHN SHAW & SONS (Salford) Ltd., Salford 3, Lancs.

WICKMAN *of* **COVENTRY**

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LEEDS · GLASGOW · NEWCASTLE · BELFAST

Wickman

230F45

KLEESTRON
POLYSTYRENE MOULDING POWDERS
THE VERSATILE PLASTIC
No need to state the virtues of polystyrene. It is accepted all over the world for its versatility . . . its adaptability. At long last the designer has been given a moulding powder reasonably free from limitations.
No need either to state the virtues of Kleestron. Enough to say it is made by Kleemann's in their new factory at Welwyn Garden City and is being sold . . . and moulded . . . and praised all over the world.
O. & M. KLEEMANN LTD.
Sole Selling Agents for United Kingdom :
EAST ANGLIA PLASTICS LTD
52 Brook Street, London, W.1
All Overseas and Export enquiries to : O. & M. KLEEMANN LTD., West Halkin Hse., West Halkin St., London, S.W.1

This is the Lustrex building in the new Monsanto works at Newport, Mon. It is a special purpose plant based on Monsanto's long experience as producers of polystyrene and designed for bulk production of this important material.

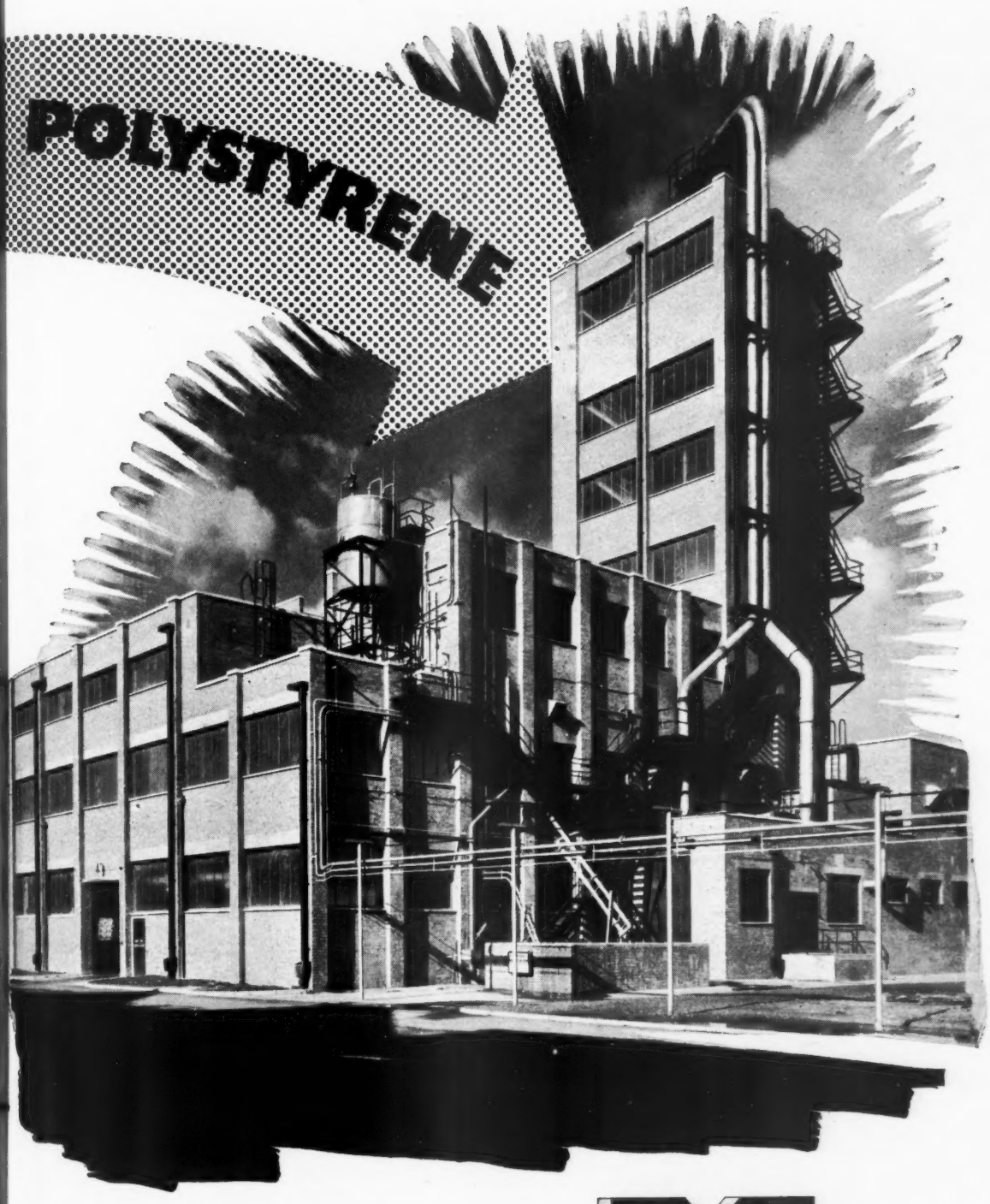
The plant came into operation, as scheduled, in September, 1950. Thus, for the first time British-made polystyrene was available in bulk in a wide range of colours.

Lustrex maintains the high quality associated with all Monsanto products and availability will improve when raw material resources are developed, but this must needs take time. This will enable British designers to further their ideas in exploiting this versatile plastic.

Lustrex *the registered trade name for Monsanto's*

POLYSTYRENE MOULDING CRYSTALS

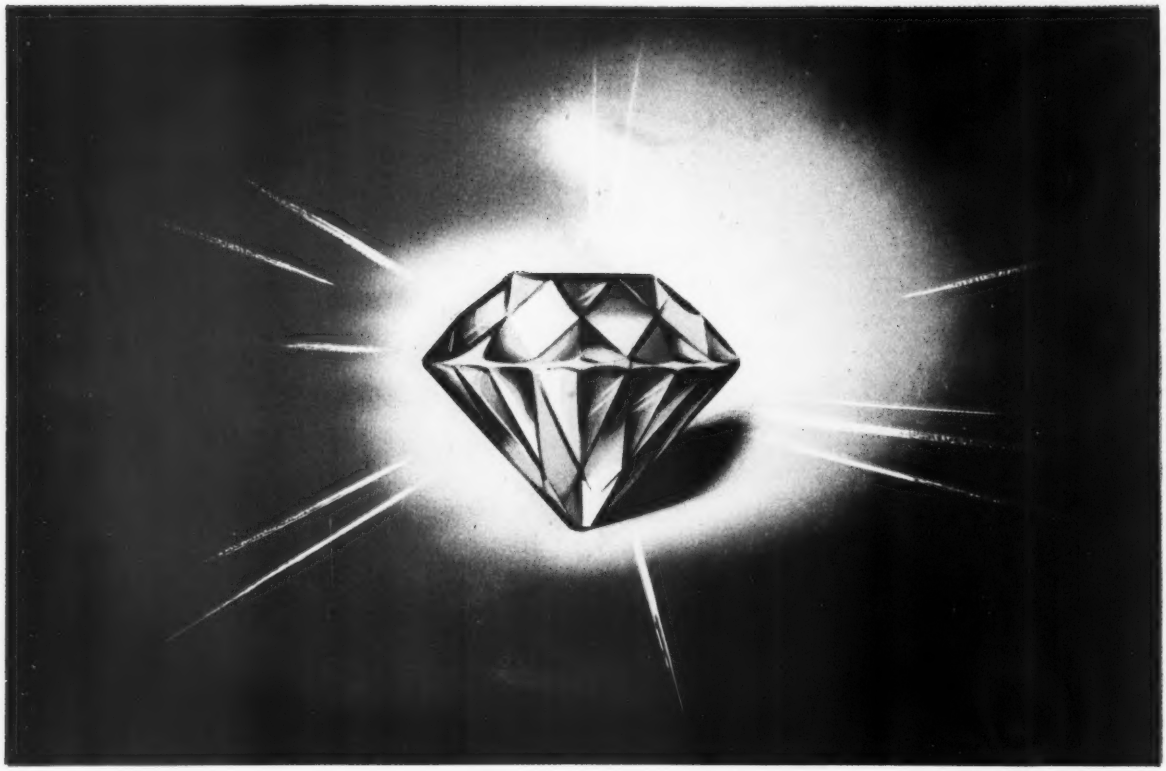
* *



CHEMICALS FOR
EVERY INDUSTRY
throughout the world

MONSANTO
CHEMICALS — PLASTICS

MONSANTO CHEMICALS LIMITED • Victoria Station House • London • S.W.1



NEW TRANSPARENT RANGE

of "WELLITE" CELLULOSE ACETATE

Sparkling . . . brilliant . . . NEW . . . these are the outstanding characteristics of the range of Cellulose Acetate Injection Moulding Powders which we have just introduced in transparent colours. Produced under strictly controlled conditions to ensure uniformity, there is a wide range to select from and we guarantee to match exactly any particular shade required. All colours are tested for fastness and heat resistance and only the finest pigments and dyes are used.

The combined experience of our technical experts is always available to advise and assist in any colour problem. Why not get into touch with us?

Welwyn Plastics Ltd

WELLITE WORKS · WELWYN NORTH · HERTFORDSHIRE

TELEPHONE: WELWYN 484

Desk Pad Stand in

CELLULOSE ACETATE

Desk pad stand in cellulose acetate manufactured for, and shown by courtesy of Raphael Industries Limited. Yet another example of our wide experience in injection mouldings in all thermo-plastic materials for a large variety of industries.

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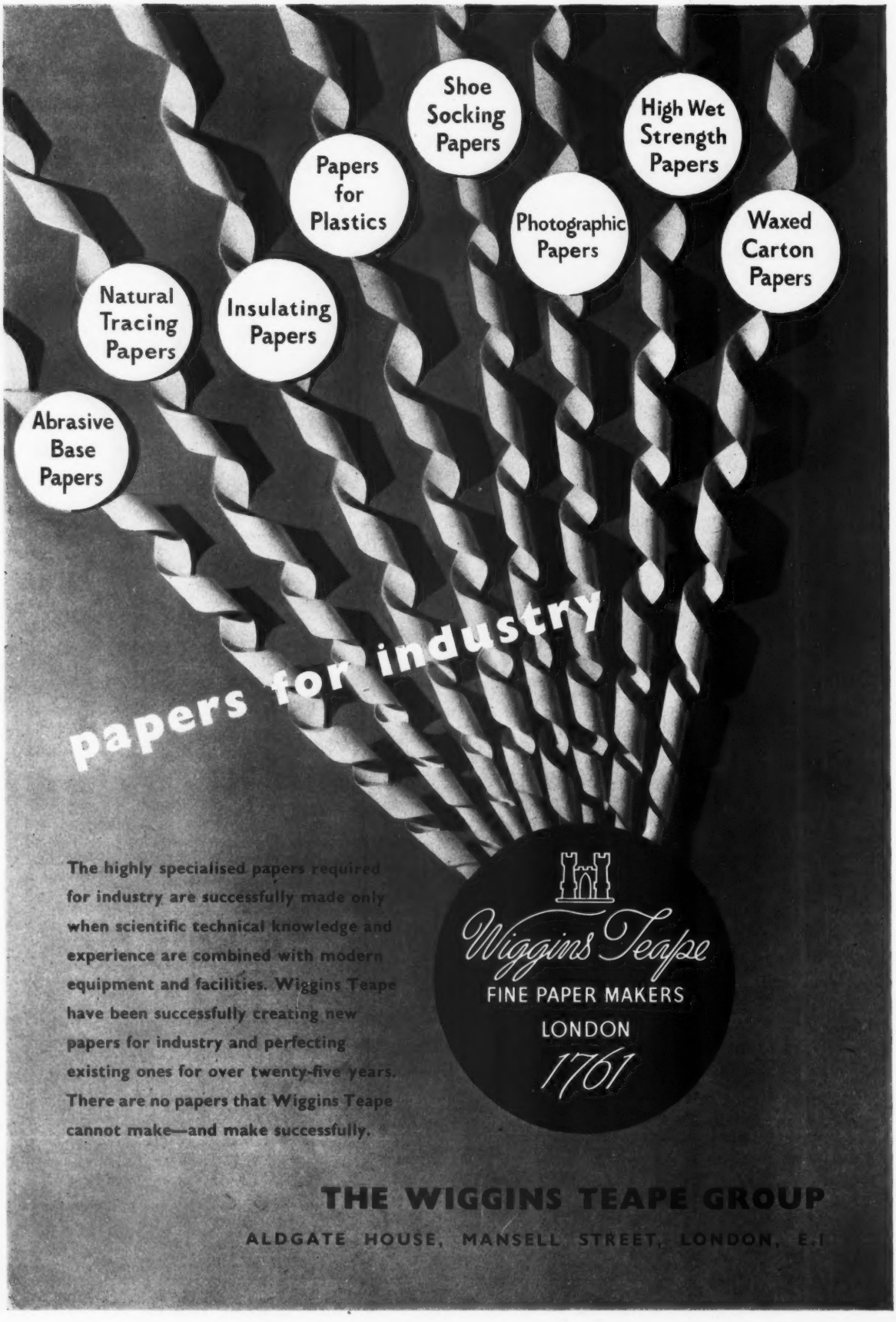
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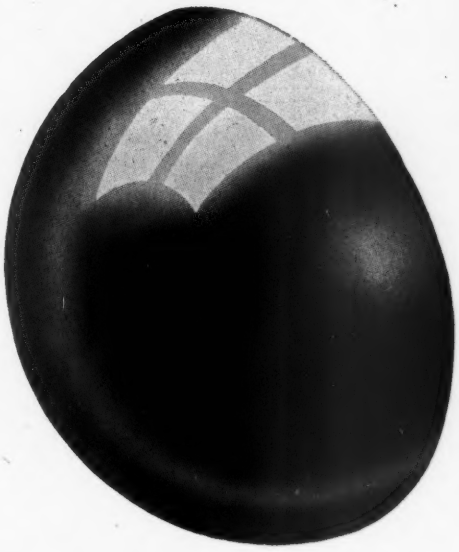

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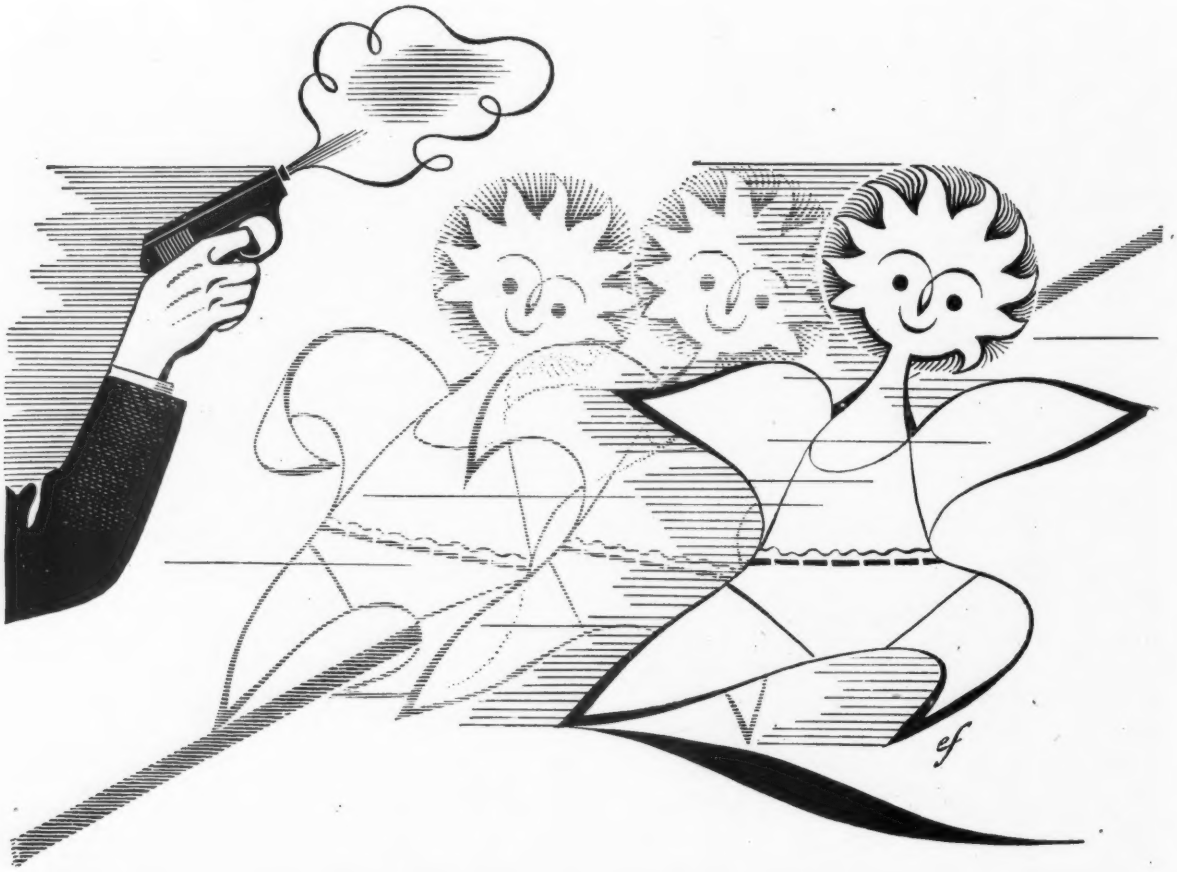

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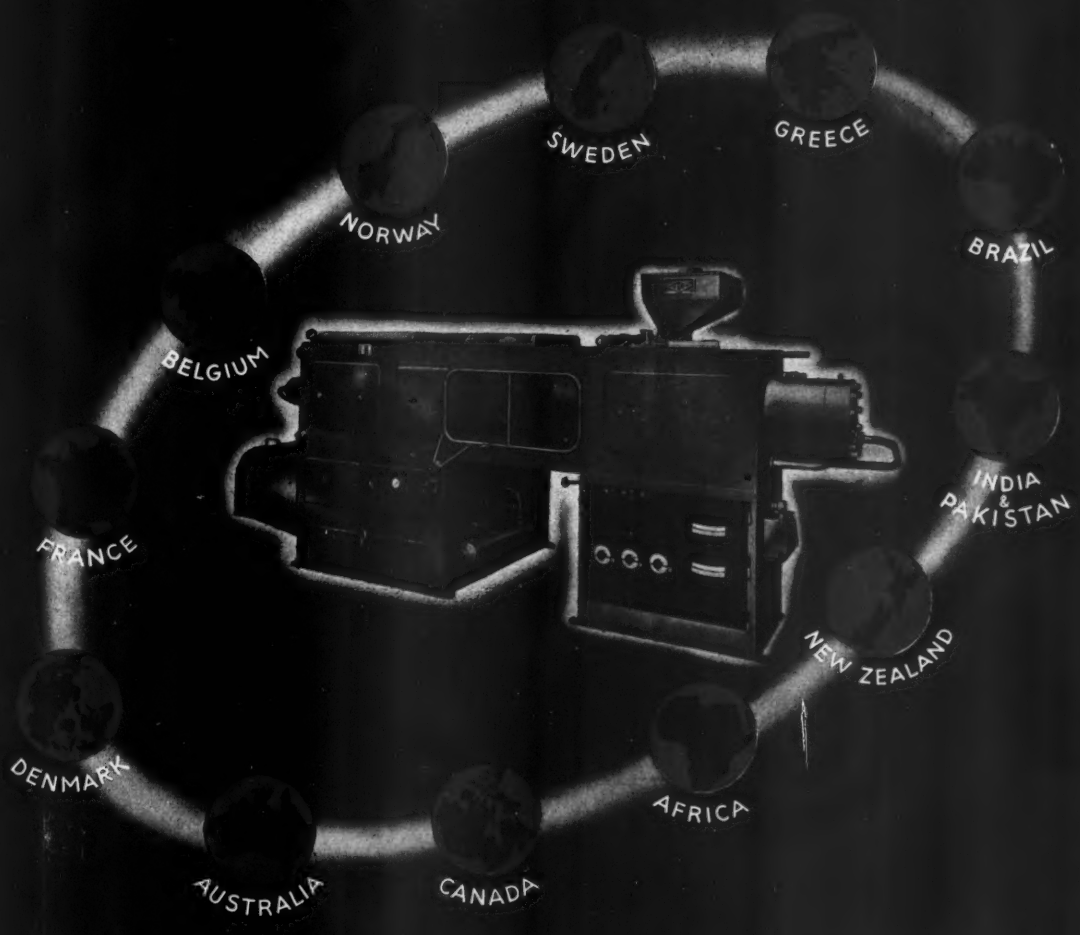

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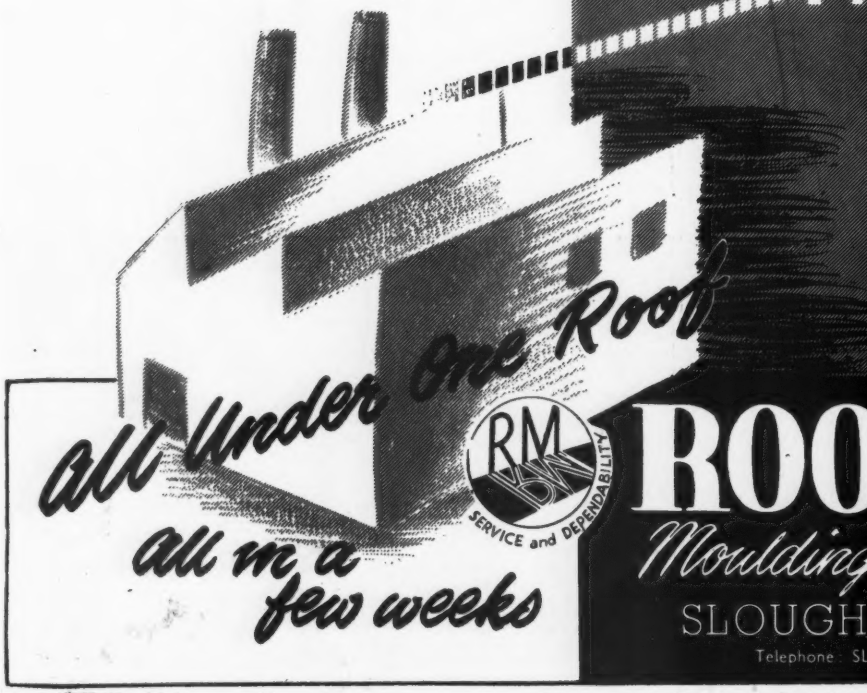

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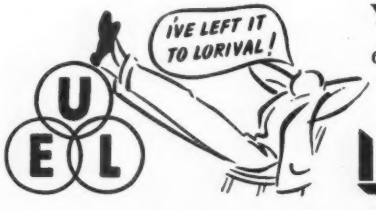

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EDITOR: M. D. CURWEN, B.Sc., A.R.I.C.

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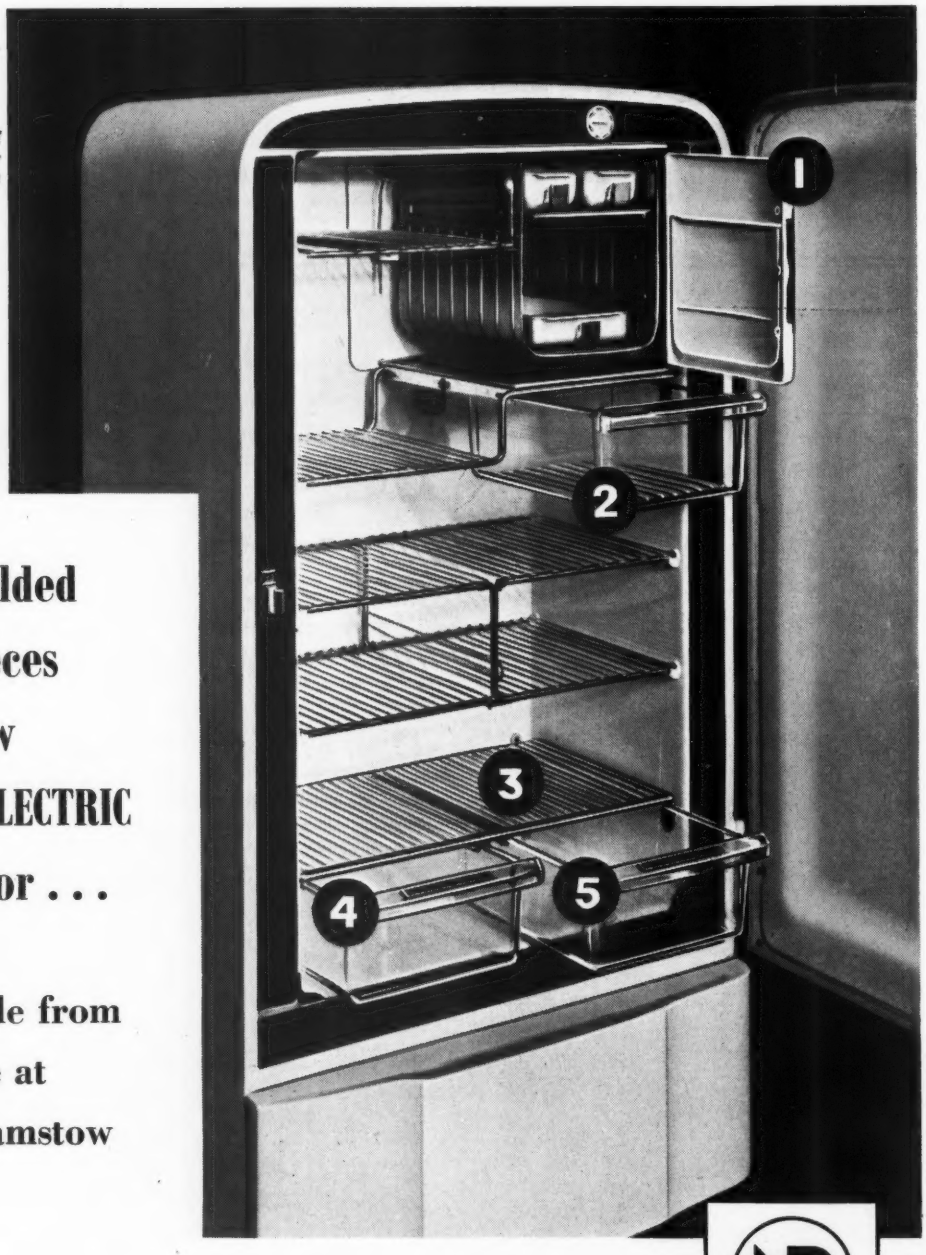

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Plastics

VOL. XVII. No. 177. APRIL, 1952

EDITORIALS

Mechanical Properties of Plastics

ON March 7 the Plastics and Polymer Group of the Society of Chemical Industry held a Symposium with Mr. G. Dring, M.A., in the chair, on the above subject. Five papers were read and on page 103 of this issue we have pleasure in publishing short abstracts of each. The proceedings were opened by Dr. N. J. L. Megson, whose splendid work at the Plastics Advisory Service, during and since the war, we all know something about, and who is now Head of the Chemistry Department, R.A.E., Farnborough. His opening remarks regarding the different forms of attack in the field of mechanical testing, our present shortcomings in our knowledge of plastics, and his analysis of the manner in which the authors of the five papers approach their problems, are all worthy of close consideration. "The days are gone," Dr. Megson said, "when plastics are used simply for the production of small items in which mechanical strength is of secondary importance and we are beginning to realize the potentialities of the materials for structural purposes." The war demanded many things undreamt of prior to 1939 and because of our ignorance of many fundamental properties, the problems were solved in an empirical way.

To-day there has arisen much interest in the mechanical behaviour of plastics, but we have yet far to go for a complete understanding of the various factors involved. It may be helpful to simplify matters, Dr. Megson said, by stating three categories, all essential and inter-related, in which mechanical testing may be approached. These are :—

a. The fundamental approach which seeks to relate molecular shape and size, or the composition of a heterogenous material, with mechanical behaviour.
b. The assessment of a material for practical use by determination of properties by means of carefully selected tests.
c. The empirical approach which uses mechanical test procedures to compare one material with another or to lay down standards.

The papers presented cover all three categories, most show more than one method of approach, and all conform in some degree with (b): clearly the utility of a material in practice must be of primary importance.

The first paper, read by Mr. Hollis, demonstrates that existing test methods with minor modifications can be adopted for the examination of small samples of thermoplastics. Their work falls into category (b) and also into (c) since the methods can be employed for comparative purposes.

The second paper by Evans and Hall is concerned with the behaviour of reinforced plastics in structures such as aircraft. Here the important properties are strength and stiffness in tension, compression and shear which is connected with impact strength. Their work is concerned with the effects caused by employing various reinforcing materials and resins, and therefore falls into both categories (a) and (b).

Dr. Hoff's paper shows how important is the fundamental approach of category (a). After considering the nature of polymer molecules, local weaknesses and so on, the author stresses the unsoundness of taking over metal techniques and expecting results of use in the plastics field. Dr. Hoff goes on to relate molecular structure to fatigue results and static loading strengths. He also emphasizes the difficulty of interpreting impact strength determinations.

Both remaining papers fall mainly into category (c). Mr. Hayes describes two plastometers designed to give comparative results in factory control work. The final paper by Bennitt and Avenell discusses the use of hardness measurements for assessing uniformity of mouldings. Both Brinell hardness and hot needle indentation methods may prove of considerable value as rapid control methods for assessing degree of cure, attack by chemicals and also composition.

Research in the U.K. and U.S.A.

ON the evening of March 7 the Plastics and Polymer Group gave a dinner at which Professor Melville of Birmingham University, who has done so much in the field of polymer chemistry, was the chief guest. He spoke on a subject of which he is especially familiar, research in industry and university; having recently visited the United States, his talk was illuminating.

It was encouraging to hear from him that this country has nothing to be ashamed of in its past and present work. On the whole we carry out proportionately more fundamental work in this country than the Americans do, while the total quantity of research in the universities of the two countries is about the same when the difference of populations is taken into account. Even more encouraging was his opinion that the quality of our research work is higher, especially in the department of engineering, and that our industrial laboratories, that is those maintained by private companies, are as well equipped as those in the U.S.A.

On the other hand, the total quantity of money spent on all research in the U.S.A., is vastly greater than is available here, and that provided by the U.S. Government forms a very large proportion of the total. With a consequent wealth of equipment and large numbers of trained scientists to operate it, the output of research is of great volume.

It was not in the province of Professor Melville's talk to speak of technical training. It is in this field, we believe, that this country falls well behind our needs, a condition different from that in the U.S.A. and, we believe, from several countries in Europe.

Urgent Appeal

AT a time such as this when the range and complexity of plastics increases with every passing year, when the process and tools for working them are becoming more varied, and when the quality and design of finished goods is of ever-increasing importance, there cannot be many better methods of placing our industry on a sound basis than by supporting and actively contributing to the Plastics Education Fund, which has been organized by Mr. P. C. Allen, the President of the Plastics Institute with the support of the British Plastics Federation. We cannot afford to be left behind in the scientific and technical education of our young workers.

The main objects of the fund are to publish monographs on the science and technology of the processes used in the plastics industry, to provide training grants to help persons in the industry studying for examinations, to help apprentices in the industry by making grants to cover books, travelling expenses and so forth, and to give assistance to educational institutions by providing and maintaining equipment and helping with the cost of literature and libraries.

The result of the appeal launched last September was, in one sense, most satisfactory, because a large part of the annual income of £4,000 aimed at will be provided by seven-year covenants, but in another sense the response was somewhat disappointing, because only a comparatively small number of firms subscribed. A second appeal note has been issued for further covenants because it is felt that an adequate number of properly trained technologists will bring considerable benefits to the plastics industry, particularly to the smaller firms engaged in it.

Trustees have been selected to represent the subscribers. In addition to Mr. P. C. Allen (Imperial Chemical Industries), Mr. T. L. Birrell (Halex), Mr. J. L. Daniels (T. H. and J. Daniels), Mr. P. A. Delafield (British Resin Products), Mr. C. S. Dingley (British Industrial Plastics), Mr. H. V. Potter (Bakelite), and Mr. A. E. Skan (Tufnol), have agreed to become Trustees and on March 6, 1952, they signed the Trust Deed.

The Trustees have elected Mr. P. C. Allen as their Chairman, and appointed Mr. S. P. Thompson (Imperial Chemical Industries Ltd., Plastics Division), as their Secretary for 1952. The Plastics Institute has been asked to act as Agent and Manager to the Trustees to carry on the day-to-day administration of the Fund.

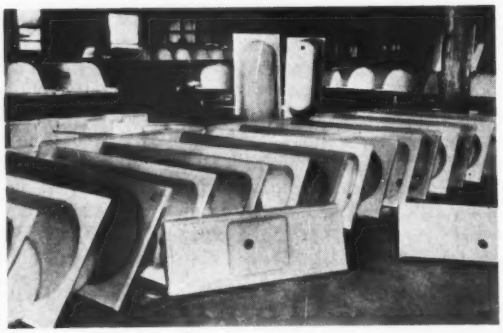
The Trustees at their first meeting decided to allot £1,000 for the award of 10 training grants in 1952 and the Plastics Institute has been asked to invite applications for these grants.

We earnestly trust that the second appeal will have the desired effect and for our part, hope that subscribers will include many of the smaller companies who, under the seven-year covenant system, may not miss too greatly an annual gift of £10 to £50; it is not too much to ensure the growth of the sound technical force we shall certainly need in the years ahead.

MOULDING POWDER AND SHOT

Geo-Plastics

While it is true that the wash-basin, sink and/or bath made from sheet acrylics are widely used in air-liners, caravans and yachts and that " medical " baths made of the same material have come to stay, it is not very likely that there will ever be much demand for such fixtures in the home in highly industrialized small countries endowed with plenty of native iron. Judging, however, from recent news I have from Australia, there are obviously big existing and potential markets for them in places very far from industrial centres, and it is exciting to see the picture we publish below of N. V. Appleton's factory in



Brisbane, Queensland. Transport costs of enamelled-iron vessels would be extremely high even if manufactured in the industrial south and " impossible " if they were imported from this country. Fabrication from " Perspex " sheet entails no great technique or expensive plant and can be installed almost on the spot. In view of the growing importance of Queensland and the rapid growth of townships (I have, of couse, read my " A Town Like Alice " !), we wish N. V. Appleton a happy future and expansion.

* * *

Genius at Work

In this Age of Enlightenment and Fuller Life, the coming of the electric washing machine, electric toaster, electric razor and soapless detergents with atom-bombarding fitments each more powerful than the other fellow's, does leave me with sufficient leisure to go out and earn sufficient to pay for the aforesaid necessities of life. Just the same, there remain a few devices for the improvement of which I have been waiting these many years. One such apparatus is that boon to human kind, the vacuum cleaner—that miracle with the one nigger in the woodpile, or rather in the bag—there still remains the emptying of the beastly thing. I am at present hesitating between inventing either a new type of extruded sheet so thin and so chockful of very tiny holes as to serve its function and yet be so cheap as to be a throw-away job, or an entirely new device made from a circular plastic plate and broom handle, the sheet being activated by rotational friction to give maximum static and de-activated by an opposite charge so as to shoot the dust and dirt through my window into the waiting dustbin. In the meantime, another of the less likeable jobs I have to perform has already been lightened greatly by one of those gadget-making geniuses who seem to hunt for hateful little jobs that must be done, and solve them by at least pleasanter methods. The one I have in mind is the cleaning of the inside of cooking pans after I have burnt the porridge or morning milk. Hitherto I have used a scourer composed of steel monofilaments in the form of a woven ball and especially provided with needle-like protuberances that result in a considerable loss of skin and my not too abundant blood. The improved device is on the market, and I now sing at my morning's work. Made of nylon, as a narrow flat extrusion curiously waved and woven into a soft and very oblate spheroid, it does the trick of removing cooking residues beautifully and effectively, and since nylon is so resistant to abrasion also, without itself wearing away. My fingers have regained their pristine smoothness.

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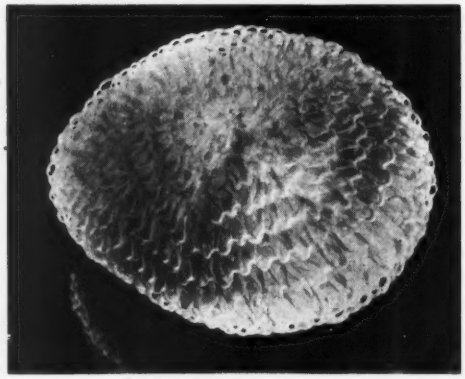


Plastics in Furniture—A Critical Analysis

By Joseph B. Singer, B.Sc. (Arch.), A.R.I.B.A.

THE transition from hand-tool methods in making furniture brought about new techniques, aimed at producing economically better quality furniture consistent with the nature of materials available. For centuries, until the advent of plywood, laminated wood, metals and plastics, solid wood was regarded as the only material suitable for furniture. The various materials which followed wood influenced the method of production in the first instance, and had certain qualities inseparably associated with well-designed furniture which can be grouped under the following headings: (1) Comfort, (2) conformity to functional requirements, i.e., fitness for its job, (3) durability, (4) ease of maintenance, (5) æsthetic appeal, and (6) competitive price.

Comfort is a quality difficult to perceive; only an experience of discomfort reveals the subtle differences in, for example, the shape of a chair, following the most restful position of the human body, support for arms, etc. The elasticity of the material and its ability to take shape in accordance with stresses, are qualities most sought for. Alternatively, upholstering is a simple solution for hard and rigid materials, though its correct distribution is of the utmost importance. Functional requirements differ considerably, and the industry must satisfy varied needs of home furniture, office and institutional furniture and specialized applications. Where furniture has often to be moved, lightness is an outstanding asset; heavy furniture has to be provided with wheels or castors, unless it rests on sledge-like runners, as some laminated wood or tubular steel chairs are designed.

The resistance of materials to wear varies; those parts of furniture which are particularly exposed to wear, such as handles, edges, table tops, shelves, etc., have to be made from hard and tough materials. Worn away corners, torn fabrics, scratched paint and polish, are common occurrences. The failure of joints in furniture is also frequent when subject to impact shocks, as in the case of chairs. Although synthetic resin-bonded members have stronger joints than are obtained with ordinary glues, bent plywood or laminated wood and moulded components are less liable to fail under these conditions. Furniture beetle attacks plywood as well as solid wood, but synthetic resin-bonded veneers and laminates have been found to be quite immune from attack.

Ease of cleaning is determined by the nature of the surface material and the shape of the article. Simple plane surfaces are easier to clean than textured surfaces. Simplicity of form is equally applicable to the exterior, as well as the interior in items such as sideboards, wardrobes, etc.; internal angles should have an easy curve in the form of a shaped fillet. Although a very smooth surface facilitates cleaning, a high polish is liable to show the smallest mark or scratch. The best results are obtained through a combination of a patterned, in preference to a plain colour surface and a smooth hard-wearing finish. Many upholstery coverings are produced in monotones whose colour range is limited by practical considerations, and a patterned covering or woven materials have therefore the advantage of a greater variety of finish; even in the latter cases, a sharp contrast in tone and texture, which minimizes the showing of marks, is recommended.

Design is not a quality applied in the form of surface

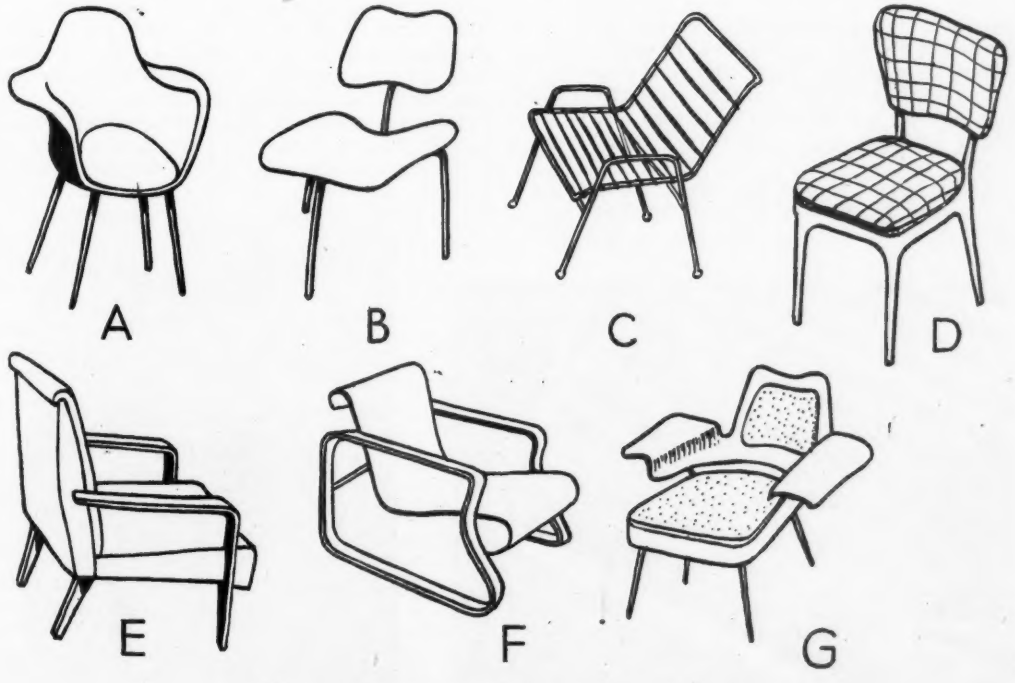


Fig. 1.—Application of plastics for chairs of various designs.

A.—Chair moulded from polyester resin-bonded glass fibre, on metal legs. B.—Office stool: phenolic resin-impregnated sisal material, on metal legs. C.—Garden chair: springs covered with flexible p.v.c. tubing. D.—Upholstery: polyvinylidene chloride woven fabric "Tygan." E.—Upholstery: vinyl-coated fabric "Vynide." F.—Armchair: resin-bonded laminated wood and bent plywood. G.—Chair back: resin-bonded and moulded plywood "Permaply," and expanded rubber padding.

Fig. 2. — Child's high chair moulded in "Beetle" urea and melamine, with tubular metal frame: Horners' Award 1951 (First prize, to Mr. A. H. Woodfull, of British Industrial Plastics Ltd.).

decoration, but a property inherent in the article and evolved through a harmonious combination of form, colour and texture. Design can be said to grow with an article, from the initial stage of inception until the article takes its final shape. Visual appreciation, unlike the art of design, is a developed ability to look critically.

To-day, the public takes a more intelligent interest in design. and can assess its quality better than some manufacturers are led to think. Originally, it was true that bad examples were the result of concentration of furniture production in factories, with the subsequent lack of exchange of ideas between artist, designer and manufacturer, as opposed to past practice in hand-made furniture. These conditions have changed to a large extent, and there is a growing number of examples which refute the idea that machine-produced furniture does not possess a quality of human warmth, which satisfies our desire of surrounding ourselves with articles of everyday use, thus giving us visual pleasure apart from the indispensable comfort.

A survey of existing furniture will confirm that, even to-day, there is a strong influence of wood forms on the design of furniture regardless of the material used; this is, perhaps, caused by an insufficient knowledge of the properties of the new materials, and not necessarily by lack of originality of approach. Every article should be expressive of the inherent characteristics of the material, as exemplified by the better strength of plywood, metals and certain plastics, in comparison to wood, and this makes it possible to produce furniture of thinner section and more graceful and lighter appearance.

Price is closely related to the quality of the material and the workmanship. A higher cost can be justified only when some particular property is much superior to that of similar articles, but even in this case the manufacturer is liable to initial losses in this highly competitive market until his product is fully assessed and its superiority is generally recognized. Mass production cheapens the product, but the variety of designs is reduced; this can be partly overcome by the use of alternative finishes or various combinations of different parts.

Chairs

An interesting development in furniture from moulded plastics is the production of one-piece moulded seat, arms and back (on metal legs), made from sisal impregnated with phenolic resins. The weight of the moulded part, without legs, is 5 lb., and it is produced in many colours. Various other types of chairs are produced from the same material, but with a separate back and seat, mainly intended for offices and schools. A child's high chair (Fig. 2), moulded in "Beetle" urea and melamine, is another example of plastics as moulded furniture. A production of similar nature has a shell moulded from fibreglass-reinforced polyester resin. The glass fibre, in 2½-in. lengths, is accumulated on a preform screen by suction, placed in a mould with pigmented polyester resin, and moulded under a pressure of 100-150 lb. per sq. in. The shell, which is padded with foamed rubber, rests on a metal cradle with fixed metal legs.

Cellulose acetate sheets have also been used for the seats and backs of metal-framed chairs by bending the sheets to a curve and riveting them to the metal members. Nylon webbings and vinyl strappings provide a flexible type of material for tubular-steel-framed chairs. The most recent development in this field is metal springs covered with p.v.c. tubing (Fig. 3). The seat and the back of this chair are formed by a series of springs, which owing to their elasticity follow the contours of the human body and stretch sufficiently to give comfort. In connection with steel-framed furniture, cellulose acetate extruded tubing can be mentioned as an impact resistant and hard-wearing coating which may take the place

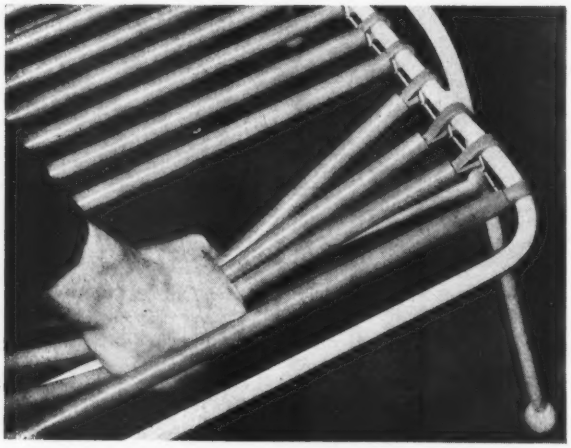


Fig. 3.—Galvanized springs covered with p.v.c. tubing are used for the seat and back of this metal-framed garden chair, first produced for use at the 1951 Festival of Britain. These chairs were made by Ernest Race Ltd., using extruded p.v.c. tube supplied by BX Plastics Ltd.

of chromium-plating in steel furniture parts. A wide range of colours, which can be chosen to match the covering, has an equally promising future in light-metal alloy furniture.

Although many materials, including polyvinylidene chloride, polythene, nylon and casein, have been extruded into monofilaments, only polyvinylidene chloride ("Tygan") has been widely used as a woven upholstery material. This fabric is generally woven from 0.010 or 0.012-in.-diameter monofilaments. It is usually calendered, heat and pressure being applied on the top and bottom roll. The temperature of 170-180 degrees F. causes the material to shrink, and thus densify the fabric. The woven fabric is produced in many attractive designs and colours, and is easily kept clean by wiping with a damp cloth.

Fabrics coated with polyvinyl chloride and with nitrocellulose (e.g., "Vinide" and "Rexine"), and unsupported p.v.c. sheeting (e.g., "Plastahide"), are used quite extensively as upholstery materials. They are applied over expanded rubber or other resilient types of upholstery, and are resilient to flexing. They can be cleaned with soap and warm water, and are available in a range of colours and designs.

The use of plywood for furniture is not new, but the introduction of synthetic resin adhesives, and new bonding and moulding techniques, have improved the durability of plywood and opened new possibilities for bent and moulded plywood furniture. The rubber-bag process procures an even distribution of pressure throughout the assembly of veneers, and ensures a more uniform glue-line strength. More complex shapes of double curvature were made possible in the manufacture of moulded plywood; in this method, veneer strips, suitably "tailored," are assembled in the mould with layers of synthetic resin between them. The whole assembly is then "cured" in an autoclave, where the temperature is raised sufficiently to set the "glue," and pressure is applied uniformly by means of the rubber bag.

Moulded plywood articles have a limitation in the amount of permissible curvature; this radius should not be less than 3 ins., if fracture of wood fibres is to be avoided. The appearance of an article depends on a skilful arrangement of the pattern and grain of wood veneers, which must be in close relation to the nature and shape of the furniture component. An analogy can be made with wood sculpture, where every line of grain is subtly conveying the static, or dynamic, character of the subject.

Laminated wood uses thicker veneers than does plywood; further, the grain of consecutive plies is arranged parallel to each other, and the product is strongest in the direction of the grain. Applied to furniture, it is used mainly for arms and legs, which are subjected to stresses parallel to the length of wood. Modern methods of heating achieve the bonding of thicker laminates; for example, in the strip heating technique, metal bands are placed on both sides of the laminated member, and a low tension current of high amperage which passes through the bands, generates heat which penetrates to the glue joints. In the electrostatic technique, an electric field oscillates at a high frequency, and so produces a uniform heat throughout the member.

Tables and Sideboards

Decorative sheet plastics, apart from wall lining and panelling, are chiefly employed for table and counter tops, sideboard panels and similar applications. They are hard-wearing and resist staining, and offer a wide choice of colour and design to match the upholstery of chairs. Manufacturers have often been criticized for trying to imitate other materials, e.g., reproducing the natural grain of wood in the surface finish. Although the selling value of attractive imitation wood veneers cannot be denied, it is the principle of copying other materials to achieve some desirable effects which is questioned. Hence this criticism is aimed mainly at stimulating the production of new patterns and finishes, compatible with plastics, which can bring fresh ideas acceptable to the public.

The easily cleaned and hygenic surfaces of laminated sheet plastics should find a ready application in kitchen furniture. Thin laminates, with a suitable backing, would find good use in tables for food preparation and similar situations.

Complete table-tops have already been moulded in one piece from phenolic resins. Lightness and strength are achieved through the use of reinforcing ribs at the underside; these provide rigidity to the table-top and better stress distribution for metal legs attachment. The tubular metal legs on such tables are coated with cellulose acetate-butyrate.

Acrylic sheets have also been used for small coffee tables. The natural lightness and potential gracefulness of articles from this transparent sheet material have not always been fully utilized. The main difficulty appeared to be the design of practical and sufficiently strong furniture, as it necessitated the use of heavier-section members, which were somewhat clumsy. Acrylic resin sheets, used in conjunction with other materials, presented the problem of a suitable treatment of the joints between the transparent sheet and other material. The need for a discriminate use of different materials and a careful detailing were particularly evident in the case of this combination.

There are several types of composite laminates which use plastics for the manufacture of furniture. The stiffness of plywood, without any appreciable increase in weight, is improved by the incorporation of a resin-impregnated paper core, in the form of "Dufaylite." This material, which is produced in standard-size sheets, 36 ins. by 12 ins., and in thicknesses from ¼ in. upwards, can be used in the construction of wardrobes, tallboys and sideboards. Similar applications exist for "Onazote," which is an expanded ebonite core material.

"Holoplast," another form of laminate incorporating wood veneers, is also employed in making furniture, especially cupboards, wardrobes, bookcases, counters, etc. The use of this rigid laminate simplifies construction and contributes to a saving in space by reducing the number of framing members.

BUILDING WITH HONEYCOMB PLASTICS

(*Continued from page 94*)

sections range from completely equipped, prefabricated sectional dwellings, having a floor area of 860 sq. ft. and an overall weight of 5 tons, to those of larger dimensions weighing up to 8 tons. Such comparatively low weights allow the complete building in sectional form to be readily transported.

For tropical climates, a special supporting framework has been devised for use in conjunction with "Eurétal" units, and this serves the double purpose of providing an efficient cooling system and also strengthens the finished structure, enabling it to resist a calculated wind force of 124 miles per hour, which is a condition rarely experienced.

Equally important to satisfying the needs of houses suitable for hot climates is the demand for living accommodation in conditions of extreme coldness. The main characteristics required for sectional "Arctic"-type huts are that the structures must be strong, light in weight, easy to assemble, and possess exceptionally high thermal insulation properties. An explorers' hut developed by Expansion Urbaine Rurale and adopted for the use of members of French Polar Expeditions is executed in "Eurétal" and provides comfortable sleeping and living accommodation for five persons. The sectional structure has a total weight of only 2½ tons, and can be assembled in a few hours to withstand the rigours of polar regions. Special attention has been given to obtaining maximum thermal insulation, by filling the honeycomb cells with "Vermiculite" while the sections are being laminated; this operation adds considerably to the weight of an unfilled sandwich, but it is essential to meet requirements.

The writer wishes to make acknowledgments to M. Edouard Albert and Expansion Urbaine Rurale for information, photographs and drawings used in this article.

Building with Honeycomb Plastics

By GEORGE MAY

In a previous article, the author reviewed the use of plastics as applied to building construction in Britain. He now describes developments in France, which take even greater advantage of these materials.

THE more economical application of plastics by the building industry has been made possible by the use of lightweight sandwich construction. In combining thin high-density "skins" with suitable low-density "cores," an exceptionally high strength-weight ratio is developed, and, in addition to the production of stable laminates which are extremely light, an equally important factor is that material costs are also greatly reduced.

"Dufaylite" resin-treated paper honeycomb core, which is the basis of low-density laminates used as prefabricated wall and roofing sections, was originally developed for weight-saving purposes in aircraft in 1944. Considered as an exportable product, the extreme lightness of this honeycomb core in itself has a certain disadvantage, as, for example, the grade of expanded honeycomb associated with building occupies a space of no less than 2,388 cubic ft. per ton.

This apparent difficulty, however, has been successfully overcome, and when the material was shown by Dufay-Chromex, Ltd., at the British Industries Fair in 1947, patents for the manufacturing process had been applied for on a world-wide basis. As a result, the interest shown by overseas buyers was satisfied by arranging for resin-treated paper honeycomb to be produced in many other parts of the world.

Among the first to complete arrangements for manufacturing "Dufaylite" abroad were Société C.C.B., of 57, Rue Pierre-Charon, Paris. In France, as in common with opinions formed in other countries, it has been appreciated that even considering the other applications for resin-treated paper honeycomb, the building industry seems likely to be the largest individual potential consumer of the material.

A great deal of experimental work has been done in combining French-made "Dufaylite" with other plastics structural materials, in order to produce laminates suitable for factory-made sectional buildings. In particular, the efforts of M. Edouard Albert, architect, 46, Rue de l'Université, Paris, should be described as those of a real pioneer in the fuller use of plastics as applied to building. Compared to traditional methods, M. Albert's ideas are quite revolutionary; in creating the "Philhome" B55 unit, he has completely rejected "dead-weight" technique and adopted that of the aircraft industry. In this way, it has been possible to produce a sectional home by replacing the greater bulk of lower cost materials with

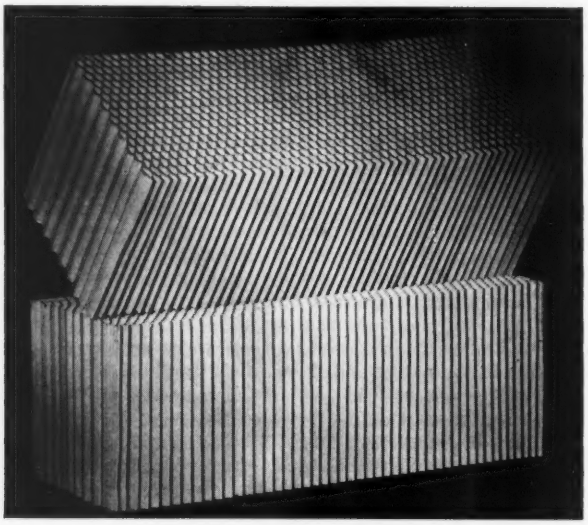


Fig. 1.—"Dufaylite" resin-treated paper honeycomb. The grade used for producing low-density laminates for house building weighs 15 oz. per cu. ft. The core thicknesses normally favoured range from 2 ins. to 3 ins., although it is practicable to produce honeycomb sections up to 1 ft. thick.

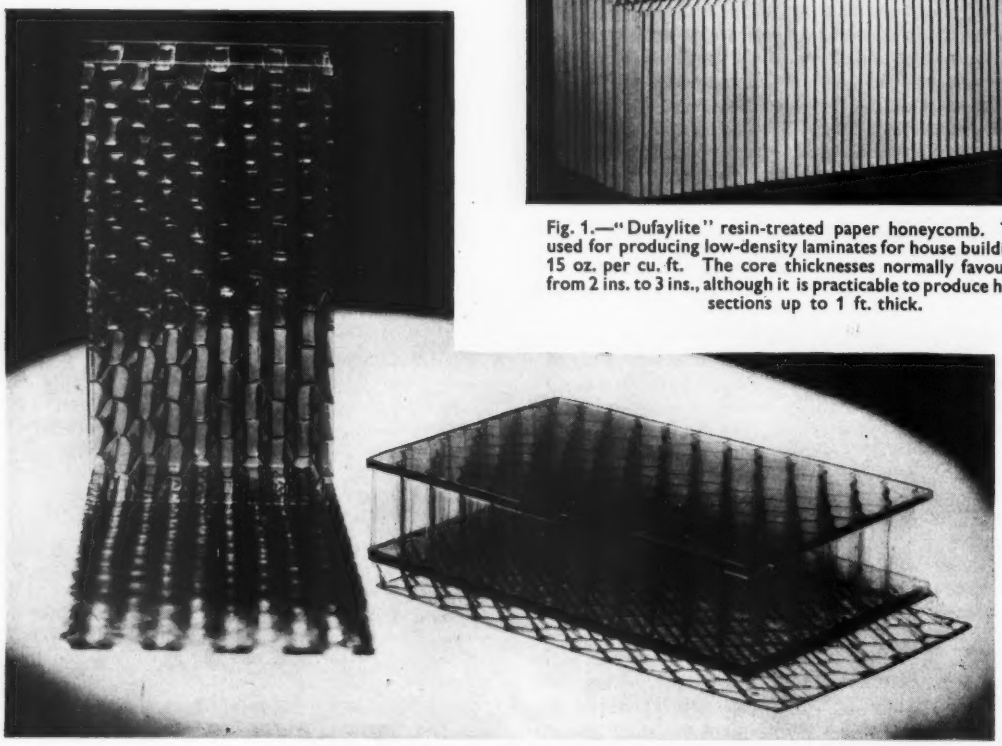


Fig. 2.—"Phantom" laminates, made by the author from cellulose acetate, demonstrate honeycomb sandwich construction used in wall panels of sectional buildings.

a considerably smaller quantity of synthetic products having high quality and superior resistance to wear and tear, humidity, fire and insect attack.

Occupying an area of 590 sq. ft., the "Philhome" unit wall structure is comprised of panels made by laminating "Dufaylite" core between two sheets of resin-treated plywood. In combination with an aluminium alloy framework, floor and ceiling sections are interlocked and guided by the wall sections which are similarly interlocked and wedged to make the assembled unit a completely integrated, superstatic cell. In order to increase the inertia of the system, this cell rests on six concrete blocks set in the ground and anchored to the floor by means of adjustable jacks to ensure perfect levelling without previous preparation of the site. This method eliminates the need for an orthodox foundation.

Fig. 3 gives details of the sandwich construction employed in the building. The use of plastics is very considerable, not only in the honeycomb core forming the bulk of the structure, but also in the resin impregnated plywood skins and the adhesives bonding skins and core together. Polyvinyl chloride plays an important part as a roofing and flooring material.

Unassembled sections of the complete house, in crates, have a total weight of only 59 cwt. and occupy a space of no more than 706 cubic ft., the largest dimension being 9 ft. 10 ins.

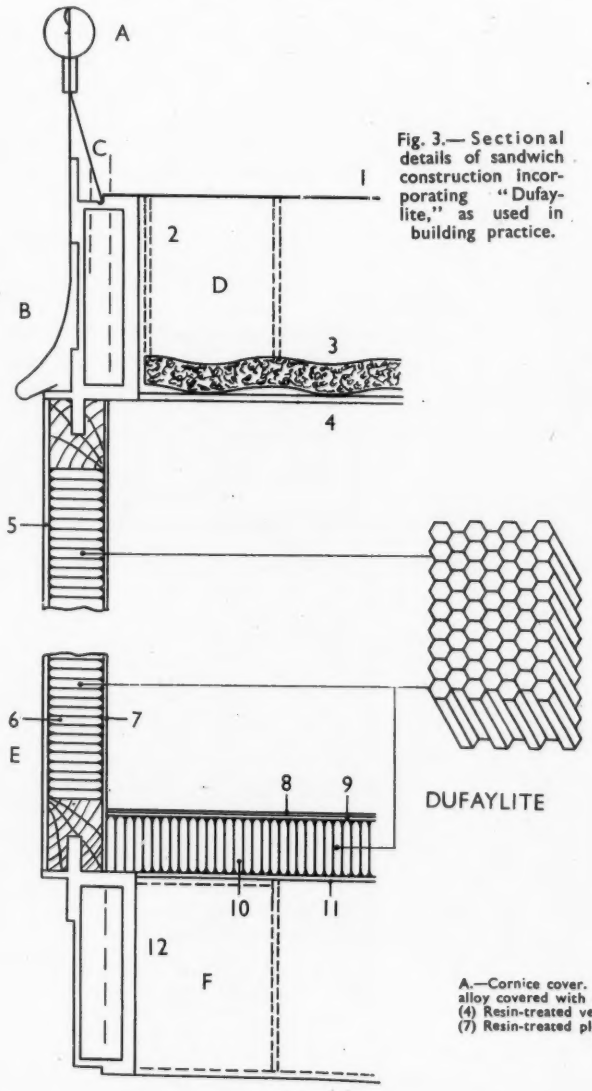
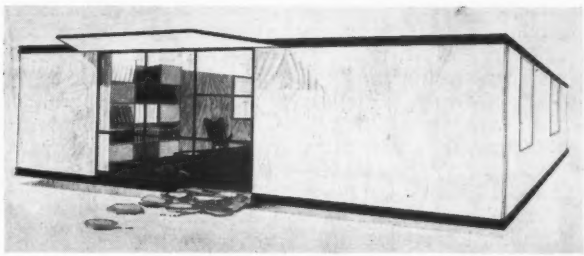


Fig. 3.— Sectional details of sandwich construction incorporating "Dufaylite," as used in building practice.



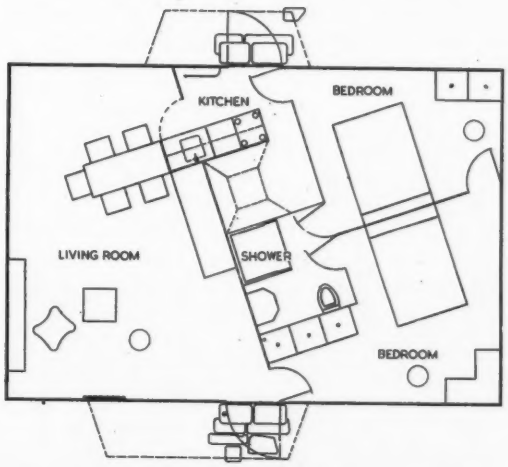


Fig. 4.—Exterior view and plan of "Philhome" B55 prefabricated house, showing unusual internal arrangement of partitions, with position of furniture and cupboards. Packed flat in sections, the complete structure can be transported in a single freight-carrying Dakota aircraft.

Transportation can be made by road, rail, sea, or even by air and the units are packed together with full instructions and diagrams showing the mode of assembly. Precision-made, prepared sections make it possible to complete the erection and installation within 48 hours.

Structural details of the "Philhome" B55 unit are as follows: Ground load, 4.26 lb. per sq. in.; floor overload, 51.2 lb. per sq. ft.; terrace overloads, 12.3 lb. per sq. ft.; wall conductivity, 0.005; sound insulation, abatement of 25 decibels; overall weight of unit, 49¼ cwt. (1.25 lb. per cubic ft.), compared with 31.25 lb. per cubic ft. in traditional building. The unit withstands a wind velocity of 80 m.p.h.

While the prefabricated house has an overall area of 590 sq. ft., a usable area of 580 sq. ft. is obtained due to the reduced thickness of the cellular walls. In the layout, illustrated by Fig. 4, a further 20 per cent. efficiency in space saving has been obtained in a unique way. As the inner walls are independent of the main structure, M. Albert, with typical French flair for originality in design, has arranged all internal partitions obliquely. In addition to making maximum use of the available space, this ingenious idea has also the artistic value of giving a wider perspective view than would be obtained by more orthodox design. This effect is accentuated in the living room by the prolongation of the roof over the glazed bay.

No usable space is lost by doors; as the location of the

A.—Cornice cover. B.—Cornice. C.—Watertight interlocking. D.—Ceiling: (1) Aluminium alloy covered with polyvinyl chloride sheet, (2) Corner plate, (3) Glass wool mattress, (4) Resin-treated veneered plywood. E.—Wall: (5) Resin-treated plywood, (6) "Dufaylite," (7) Resin-treated plywood. F.—Floor: (8) Polyvinyl chloride tiles, (9) Plywood, (10) "Dufaylite," (11) Resin-treated plywood, (12) Corner plate.

inside doors at the ends of the walls allows for maximum continuous surfaces and by the arrangement of intercommunicating doors, unnecessary steps are saved, while at the same time each room is kept completely self-contained.

The above novel features in design succeed in providing accommodation calculated to be equal to that of an area of 810 sq. ft., using traditional planning. Switches and power points are incorporated in the laminated sections, ready for connecting into wiring systems for lighting and heating; in addition, careful consideration has also been given to built-in, labour-saving equipment.

The porch roof is adjustable, and may be arranged to let in oblique sunlight in the winter or to screen the sun's rays in summer. Further comfort for tropical climates is provided by a film of water allowed to flow over the polyvinyl chloride roof covering, as a means of obtaining a cooler temperature.

This prefabricated dwelling is an outstanding example of synthetic materials applied both structurally and as a means of providing protection and decoration to the entire surface areas of the building. Being constructed from standard, precision-made sections, the building may be enlarged without difficulty, as the walls are fitted to the outer edges of the floor and ceiling components.

Fig. 5.—Laminated honeycomb units are used to provide office accommodation in an industrial building.

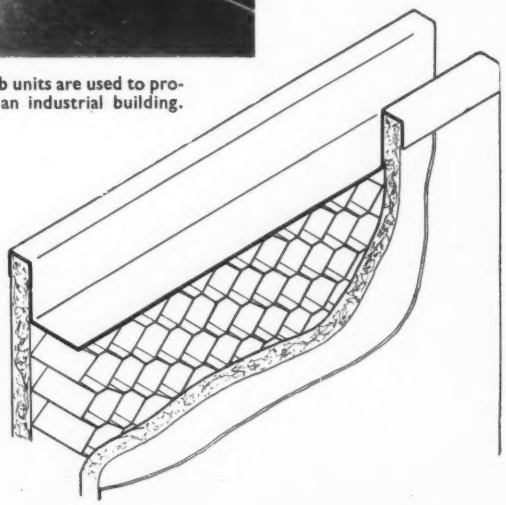


Fig. 6 (right)—Eurélithe building units consist of a "Dufaylite" core faced with plasterboard skins, the latter being specially treated for external use. Metal channel serves the dual purpose of edge scaling and as a means of linking the panels together.

Contemporary work on lightweight buildings has also been carried out by Expansion Urbaine Rurale, of 5 Rue Beaujon, Paris. This company has devised a constructional system based on a "Dufaylite" core sandwiched between two sheets of plasterboard, the outer face of the laminate being specially treated for external use.

The combination is marketed under the trade name of "Eurélithe," and standard-size sections are supplied as wall, door, window or cupboard units. Exposed edges of the laminates are sealed by metal channelling, which also serves as a means of accommodating the accessories used to key the units together.

The system comprises factory-made sections which can be applied by contractors for the speedy erection of many types of buildings.

"Eurélithe" prefabricated sections are both practical and economical, the method of assembly is impressive in its simplicity, and the many agreeable characteristics of the laminated panels include a high resistance to fire. A subsidiary application to the main function of the system, is that "Eurélithe" units have been found to be suited for the internal partitioning of existing buildings. For example, large factories or offices may be divided as required by installing the selected sections. Fitting is easily done, takes little time, and does not deteriorate the main structure, the units being readily dismantled or rearranged at will.

Expansion Urbaine Rurale have also developed a constructional laminate comprising "Dufaylite" honeycomb core bonded between two non-oxidizable metal skins. In this case, the honeycomb core is laminated directly to the metal by means of a plastic adhesive specially devised for the purpose.

First, the skins receive a coating of the resin in solution. This is allowed to dry until it is solvent free, and the panels are then heated until the plastic film is almost liquid. Sandwiching with the core takes place immediately after the skins have been removed from the oven, and a tenacious bond is obtained as soon as the assembled panels have cooled to room temperature. The honeycomb and metal combination is known as "Eurétal."

Types of colonial bungalows constructed from "Eurétal"

(*Continued on page* 91)

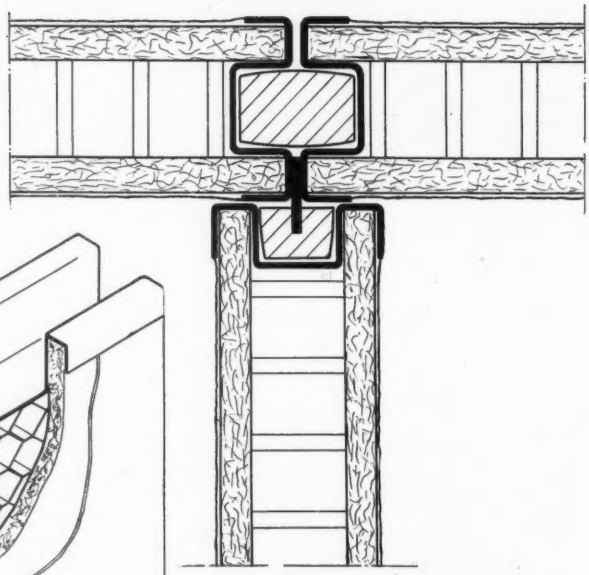


Fig. 7 (above)—Details of the wedge system employed in assembling laminated honeycomb building sections.

LETTERS TO THE EDITOR

Correspondents are reminded that a stamped and addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

Light-polarizing Plastics

SIR,—We have read with interest the Editor's Note to a letter from Dr. Trevis, of Italy, published in the February issue of "Plastics" (page 47) concerning light polarizing plastics.

Your note states that the only manufacturers of polarizing material in England are Polarizers (United Kingdom), Ltd., but I would like to point out that they are the distributors of the American "Polaroid" material. The only makers of polarizing material in Britain are ourselves, and we would be glad if you would put our name on record in this connection.

SALFORD ELECTRICAL INSTRUMENTS, LTD.

Peel Works,
Silk Street, Salford, 3.

Acetate Film Incorporating Iron Oxide

Sir,—We require supplies of film cast cellulose acetate or ethyl cellulose, 12 ins. wide, or wider, with iron oxide incorporated prior to casting. Film which is coated on one side with iron oxide, as in sound-recording tape, is not required.

W. H. ADAMSON.

39, Hedley Street,
Maidstone.

Nylon Moulding

Sir,—We are interested in producing in nylon certain small component parts which are at present made in brass and steel. We shall be glad to have the names of manufacturers of the moulding material and the names of makers of small machines for injection moulding. We would also like to know of moulders who can produce small gearwheels, components in nylon.

TRUMETER CO., LTD.

Milltown Street,
Radcliffe, Lancs.

[EDITOR'S NOTE: I.C.I., Ltd., Plastics Division, Welwyn Garden City, Herts, are the only manufacturers of nylon moulding materials in this country. Makers of small injection moulding machines include Hupfield Brothers, Ltd., Dalston Gardens, Stanmore, Middx; The Projectile and Engineering Co., Ltd., Acre Street, Battersea, S.W.8; R. H. Windsor, Ltd., 16, Finsbury Square, E.C.2; Dowding and Doll, Ltd., Greycoat House, Greycoat Place, Westminster, S.W.1. Nylon mouldings are produced by Punfield and Barstow (Mouldings), Ltd., Basil Works, Westmoreland Road, N.W.9; Plastic Engineers, Ltd., Treforest, Glamorgan; Injection Moulders, Ltd., Westmoreland Road, N.W.9; Insulators, Ltd., Leopold Road, Angel Road, Edmonton, N.18; British Moulded Plastics, Ltd., Walthamstow, E.17.]

Gramophone Records

Sir,—Kindly let us have the names of makers of "preforms" of compounded vinyl co-polymer resin as used for moulding plastics gramophone records. These are required for export.

ROBERT BRYCE AND CO., LTD.

738-741, Salisbury House,
London Wall, E.C.2.

[EDITOR'S NOTE: We suggest that you contact Bakelite, Ltd., 18, Grosvenor Gardens, S.W.1; British Geon, Ltd., 21, St. James's Square, S.W.1; and BX Plastics, Ltd., Higham Station Avenue, South Chingford, E.4.]

Circuit Diagrams

Sir,—Can you possibly give us any information as to the correct methods of laminating circuit diagrams, etc., printed or photographed, between two sheets of cellulose acetate 0.03 in. thick?

We are producing an indifferent job with acetone as a solvent, pressing between hot platens and after a few minutes transferring to a cold press. It would appear that a special paper impervious to the solvent is required in order to remain opaque.

PERSIGNS.

12c, Stedman Road,
Southbourne, Bournemouth.

Plastics Pipe

Sir,—We have been recommended to approach you for the name and address of a supplier of plastics pipe for yacht toilets.

CLARE LALLOW.

Cowes, Isle of Wight.

[EDITOR'S NOTE: Plastics pipe such as you require is supplied by Tenaplas, Ltd., Upper Basildon, nr. Pangbourne, Berks; I.C.I., Ltd., Plastics Division, Welwyn Garden City, Herts; Telegraph Construction and Maintenance Co., Ltd., Greenwich, London, S.E.10.]

Brooch Parts

Sir,—I shall be glad to hear of a manufacturer of plastics parts for making "everlasting flower" brooches, i.e., brooches with a coloured plastics back and a covering disc of clear "Perspex."

J. MCINTOSH.

77, Forthill Drive,
Broughty Ferry, Angus.

"World's Industry Employs Plastics"

SIR,—Under the heading of "World's Industry Employs Plastics," in your November edition, the notes on "Avoiding blisters and depressions on injection mouldings" and "Internal stresses in injection-moulded polystyrene components," are of particular interest to me. I should be most grateful if you could inform me whether it is possible to obtain more details in connection with each article.

PERCY BURNS.

1A, Ferndale House,
Ferndale, Tunbridge Wells.

[EDITOR'S NOTE: The complete articles were published in "Kunststoffe," 1951, August p. 257 and Sept. p. 286. Copies of this journal can be seen at the Patents Office Library, Southampton Buildings, Chancery Lane, London, W.C.2.]

Plastics Webbing

Sir,—We have an inquiry from the British West Indies for woven plastics webbing, similar to that supplied by the Lawnite Co., of Florida, U.S.A., and which would be suitable for chair bottoms and backs, especially for garden use and beach use. The samples we have are all coloured and about 2 ins. wide, and we would like to contact British manufacturers of similar material.

J. R. MARTIN AND CO., LTD.

31, Budge Row,
Cannon Street, E.C.4.

Prototypes

SIR,—Could you suggest a company who undertake the development of plastics prototypes of inventions?

F. CRAIG.

21, North Street,
Brighton.

P.V.C.-covered Cables

Sir,—We would be grateful if you could supply us with the names of manufacturers of p.v.c.-covered automobile cables, as we wish to purchase large quantities in various colours.

L. J. REYNOLDS AND CO. LTD.,

Honan's Quay,
Limerick.

Containers

Sir,—Can you advise us of the name of a maker of rolled containers in clear cellulose acetate?

ABBEY PRODUCTS.

14, Boulton Road,
Southsea, Hants.

Rings for Shopping Bags

Sir,—I wish to contact suppliers of plain or fancy rings, from 2½-in. to 3½-in. diameter, which would be suitable for handles for string shopping bags.

D. M. ROGERS.

15, Boundary Drive,
Hunt's Cross, Liverpool.

Tooth-brush Tubes

Sir,—We require some tubes for packing purposes, similar to those used for tooth-brushes.

PICKFORD AND PICKFORD LTD.

27, Mamrion Road,
Southsea, Portsmouth.

British Plastics Federation Notes

A NEW record in direct exports of British plastics materials and products during 1951, to a total value of £19,566,127, is disclosed in the annual report of the British Plastics Federation for 1951.

Direct Exports.	1950. £	1951. £
Plastics materials ..	9,129,285	16,329,704
Plastics not elsewhere specified	2,364,362	2,667,727
Plastics toys (excluding dolls)	448,194	569,096

Exports of plastics materials alone rose from 20,707 tons in 1949 to 37,806 tons in 1950, and 53,147 tons in 1951.

Membership

The total membership of the Federation at December 31, 1951, stood at 259; at the end of the previous year it was 248, there having been 16 resignations and 27 new members during 1951. Individual membership of the various Groups and Sections, at December 31, 1951, was as follows:—

Plastics Material Manufacturers Group, 42 members.
Sections:—
- Moulding powder manufacturers .. 17
- Synthetic resin manufacturers .. 18
- Sheet manufacturers 22
- P.V.C. compounders 7
- Surface coating manufacturers .. 12
- P.V.C. sheet manufacturers 15

Moulders' Group, 119 members.
Sections:—
- Moulded closure manufacturers .. 23
- Injection moulders 75
- Compression moulders 99
- Midland Sub-section 24
- North-west Sub-section 18
- Hardware Trade Section 22

Fabricators' Group, 59 members.
Sections:—
- Extruders 21
- P.V.C. fabricators 13
- Laminated material fabricators .. 13
- General fabricators 22
- Plastics-coated fabric manufacturers 4

Engineers' Group, 29 members.
Sections:—
- Mould and tool manufacturers .. 11
- Plant and packaging manufacturers 20

Raw Material Suppliers' Group, 28 members.
Sections:—
- Tar acid manufacturers 11
- Filler suppliers 9
- General chemical suppliers 9

Laminated and Fibrous Products Group, 12 members.

Associate Members' Group, 7 members.

Standardization

The following draft specifications were completed during the year and forwarded to the British Standards Institution: Polythene tube for cold water services; polythene tube for chemical plant and foodstuffs; polythene insulated p.v.c. sheathed cables; polystyrene wall tiles; plastics sinks; synthetic resin phenolic laminated sheet.

Codes of Practice were prepared for the use of polythene tubes for water services and also polythene tubes for chemical plant and foodstuffs.

Work continued during the year on the following draft specifications: Flame resistant p.v.c. sheeting; thick p.v.c. sheeting; p.v.c. compounds for extrusion purposes; p.v.c. compounds for water pipes, chemical plant and foodstuffs; plasticized p.v.c. tubing for cold water services; unplasticized p.v.c. tubing for cold water services; unplasticized p.v.c. tubing for use in chemical plant and food industries.

Existing or new committees started work on the following draft standards: Moulded trays; moulded ashtrays; mould die sets for injection moulding machines; embossed p.v.c. sheeting. Codes of Practice were taken in hand for unplasticized p.v.c. tubing for cold water services, and unplasticized p.v.c. tube for chemical plant and food industries.

Election of Officers, 1952-53

The following officers of the Federation were elected for the Session 1952-53: Mr. C. S. Dingley (executive director, British Industrial Plastics, Ltd.), chairman; Mr. A. E. Skan (managing director, Tufnol, Ltd.), vice-chairman; Mr. P. A. Delafield, immediate past chairman; Mr. R. P. Anderson, re-elected hon. treasurer. Members of Council: G. Allan, G. S. Bache, G. F. Bassett, S. T. Ellice Clark, G. H. Duncan, D. H. Evans, S. A. Goode, A. E. Hancock, R. K. Hartley, J. Harvey, A. A. Heath, H. L. Hill, A. O. R. Johnston, E. Gibson Knight, P. H. Lane, C. C. Last, R. W. Lowe, R. Maitland, W. C. Martin, W. M. C. Norie, A. E. Phipps, N. B. Punfield, D. Radford, G. G. Ritchie, N. Rolaston, P. Russell, J. E. Sisson, A. G. Snell, D. Sullivan, A. A. Tomkins, W. Chas. Waghorne, C. G. Wilde, A. H. Wilson, H. C. Worsdall. Co-opted members of Council: H. A. Collinson, H. V. Potter, W. M. York.

Bowen Prize Fund

The Council of the British Plastics Federation, as administrators of the Bowen (Cables and Plastics) Prize Fund, will offer prizes of value up to £150, with a maximum of three prizes, for award in July, 1953.

The prizes will be awarded for papers on original investigation in engineering and/or physical problems relating to compression, transfer or injection moulding. Such contributions may, if desired, be read before the Plastics Institute or its branches, or the Plastics and Polymer Group of the Society of Chemical Industry, or the Convention held in connection with the British Plastics Exhibition in June, 1953; they may also be submitted direct to the Federation.

Papers which are submitted should be accompanied by a letter signed by a responsible official representing employers, giving permission for the author to submit the contribution. Authors of contributions if not employed by an industrial undertaking should state their occupation.

Entries must be sent to the General Manager, British Plastics Federation, 47-48, Piccadilly, London, W.1, to reach him not later than first post on Friday, July 31, 1953.

Horners' Awards

The Council of the British Plastics Federation, as administrators of the Worshipful Company of Horners' Awards, offer a prize of the value of 50 guineas for a design for an article made wholly or mainly in plastics.

The design submitted must be accompanied by: (1) a working drawing; (2) a full written description of the proposed process for manufacturing the article; (3) a statement of the type or types of plastics materials recommended to be used, and (4) a three dimensional model or mock-up of the article.

Entries will be restricted to: (i) toys, and (ii) games. and candidates should take into consideration the importance of the export market and/or the use of toys or games for occupational therapy.

The prize is open to employees (twelve months' standing or more) of member firms of the British Plastics Federation. Entries, on which the name of the candidate must not be written, should be submitted with the following information in a covering letter: Name, address, and age of the employee, name of employers, and length of time he has been employed by them, and with a letter from a responsible official representing his employers, giving permission for the entry to be submitted.

Neither the Federation nor the Worshipful Company of Horners claim any copyright in the designs submitted. In judging the competition, originality of design and suitability of the plastics material to be used will be taken into account.

Entries should be sent to the General Manager, British Plastics Federation, 47-48, Piccadilly, London, W.1, to reach him not later than Thursday, July 31, 1952.

Mr. C. S. Dingley, chairman, 1952-53.

Mr. A. E. Skan, vice-chairman, 1952-53.

World's Industry Employs Plastics

INDUSTRIAL APPLICATIONS

Replaced by plastics.—A special 24-page editorial section deals with the use of plastics as alternative materials in the field of engineering. The range of materials and properties are described and projects in which plastics have already replaced other materials are illustrated. ("Materials and Methods," 1952/Feb./100.)

Plastics guards for aerial wire.—Telephone wires to the premises of the subscriber are protected by wound tubes of cellulose acetate butyrate (Tenite II) pigmented with 1 per cent. carbon black. ("Bell Laboratories Record," 1951/Nov./497.)

Cellulose acetate filled coils are being employed by Bell Telephone Co. in all new designs of telephone switching apparatus. ("Bell Laboratories Record," 1951/Nov./514.)

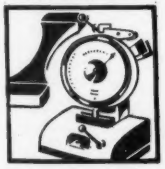
CONSUMER GOODS

Plastics buttons.—H. Petry surveys development properties and market conditions of compression- or injection-moulded buttons. ("Kunststoffe," 1951/Nov./391.)

Plastics in vacuum cleaner as replacement for steel are said to have solved material shortage and improved quality. It has been made lighter and more attractive, operates more quickly, but has not become cheaper. ("Product Engineering," 1952/Jan./142.)

Cosmetics and other chemicals are preferably sold in polyethylene bottles. American products and market position. ("Chem. Week" (Philadelphia—New York), 1951/Vol. 69, No. 9/29.)

MATERIALS and TESTING



Stretching and relaxing of polyethylene. — R. A. Horsley and H. A. Nancarrow investigate cold-stretched extruded filaments by an X-ray beam of very small cross-section. The orientation over the region of the neck produced by stretching at room and lower temperatures was found to be abnormal. Tentative explanations are advanced. ("Brit. Journal Appl. Physics," 1951/Dec./p. 345.)

Flow properties of plastics in particular fibres have been investigated by S. A. Rossmassler and H. Eyring using a sinusoidal rate of loading. The significant values for the flow process are dependent on the frequency of the vibration. (Utah University, Salt Lake City, 1949.)

Effects of X-rays upon plastics.—M. J. Day and G. Stein found that a few samples of commercial "Perspex" and others when irradiated with X-rays showed an appreciable change in colour. E. E. Schneider, M. J. Day and G. Stein also reported on paramagnetic resonance found on a number of plastics after irradiation in a 200-kV X-ray therapy set. ("Nature," 1951/Oct. 13/644.)

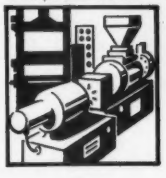
Cracking sensitivity of polyethylene polymers.—W. C. Ellis and J. D. Cummings undertook tests with conventional creep testing methods. The sensitivity to cracking in the presence of an active agent decreases with increasing average molecular weight of the polymer. (A.S.T.M. Bulletin, 1951/Dec./47.)

Strippable protective coatings for acrylic plastics have been investigated by H. G. Pfleiderer and R. A. Machlowitz for the following properties: sprayability, "delivery rate" viscosity, effect on stressed plastics, etc. Their conclusions form the basis for a specification. (A.S.T.M. Bulletin, 1951/Dec./59.)

Effectiveness of plasticizers on polyvinyl chloride.—W. Knappe and A. Schulz determined the effectiveness of plasticizers by refractometric methods. ("Kunststoffe," 1951/Oct./321.)

Lead stabilizers for polyvinyl chloride compounds. — After explaining the mechanism of decomposition, E. Escales derives the requirements for an effective stabilizer and surveys critically those based on lead. ("Kunststoffe," 1951/Oct./327.)

PROCESSES : MACHINERY



Production of fountain pens. — American practice uses transfer moulding of polystyrene. Ink cartridges are moulded separately in "Plexene," with ring gate located on cartridge taper. (U.S. Dept. of Commerce, Techn. Divn. Report IR5875.)

Manufacturing problems with phenolics.—A. P. Landall gives a short "trouble shooter's" guide considering new information on phenolics and applying it to solving practical moulding problems. ("The Machinist," 1951/Dec. 22/ p. 1948.)

Hot air welding of plastics.—F. Charity shows that soldering, hot-sealing, spot-heating and curing can be done by a "hot jet" technique at 650 degrees F. ("The Machinist," 1951/Dec. 22/p. 1950.)

High-frequency welding of thermoplastics.—H. Pischke describes the modern process of continuous thermal seam welding and the apparatus used for this purpose. ("Industrie-Anzeiger," 1951/Dec. 4/4.)

Moulding glass-reinforced plastics.—Photographic account how a vacuum cleaner dust bowl is made from glass-reinforced polyester resin. ("Machine Design," 1951/Vol. 23/154.)

Drawn laminated mouldings.—A survey on the method for the production of various types of deep, shallow and intricately shaped articles is given, by three Indian technologists. ("Journ. of Scientific and Ind. Research (India), 1951/Nov./442.)

MISCELLANEOUS USES

Plastics at the Hanover Building Exhibition. — This exhibition gave a comprehensive survey about plastics, their manufacturing techniques and applications. The working committee of the plastics industry appointed a special committee, with H. J. Saechtling as chairman. A condensed survey is given. ("Kunststoffe," 1951/Sept./289.)

Reports of technical committees.—Several reports of the activities of committees dealing with technical problems in the field of plastics in Germany have been given. A working committee of the German Plastics Industry (Arbeitsgemeinschaft Deutsche Kunststoff-Industrie) was founded in February, 1951, and intends to establish a Deutsches Kunststoff Institut." The "Gesellschaft Deutscher Chemiker" has a Plastics and Rubber sub-committee. The Standards committee on plastics has issued a number of standards and more are in preparation. The organization for standardization of moulding masses and quality survey has been re-established. ("Kunststoffe," 1951/Oct./332.)

Versatility of plastics.—In the present emergency, time is stressed in a general article giving useful considerations for replacement of metals and other materials. ("Product Engineering," 1951/Oct./134.)

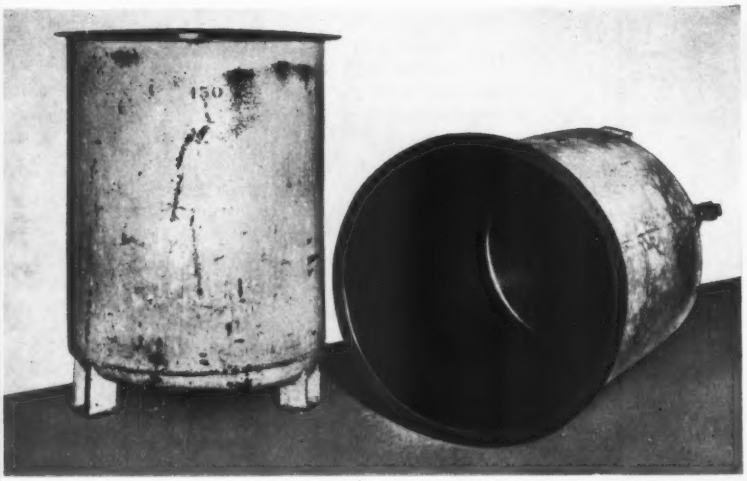
Coloured porous rubber soles.—New production methods for rubber soles have been developed in the U.S.S.R. (Legk. Promysl (Moscow), 1951/Vol. 11 No. 9/ p. 29.)

PLASTICS
IN THE SERVICE OF MAN

A pictorial review of high-quality units moulded or otherwise fabricated in Great Britain . . .

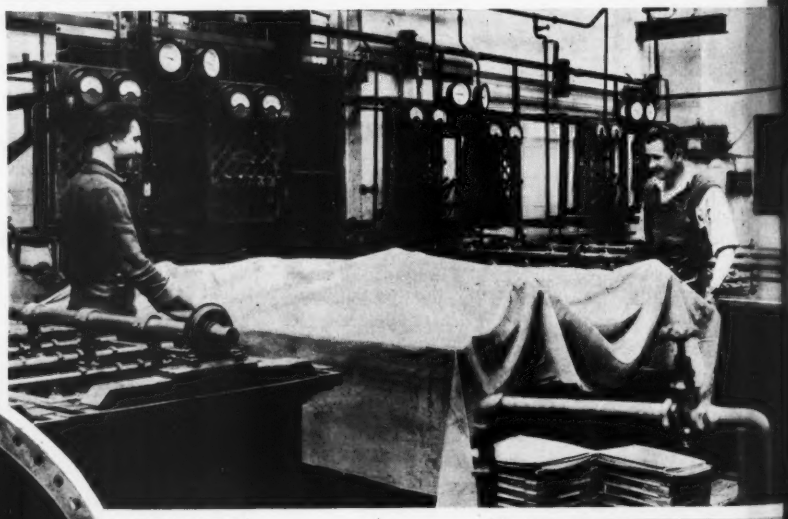
27. Chemical Industry—2.

(Above) Welded protective clothing, for operators handling dangerous chemicals such as agricultural sprays, is manufactured by Plysu Products, Ltd., from p.v.c. sheeting supplied by Commercial Plastics, Ltd.

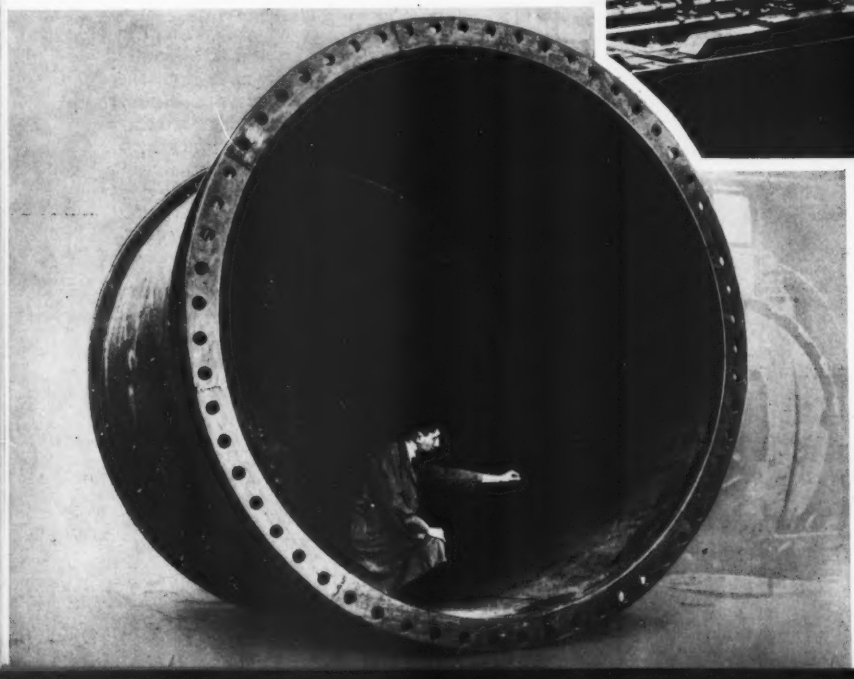


(Below) Covers for the plating tanks used in the record factory of the Decca Record Co., Ltd., are made by Plysu Products, Ltd., from p.v.c. sheeting.

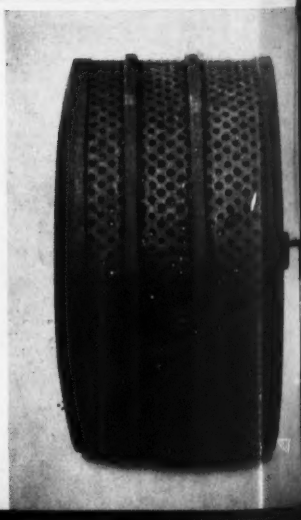
(Above) Chemical tanks and similar apparatus can be lined with a corrosion-resisting fused coat of polythene, using the flame-spraying method of Schori Metallising Process, Ltd. ("Plastics," 1947/52).

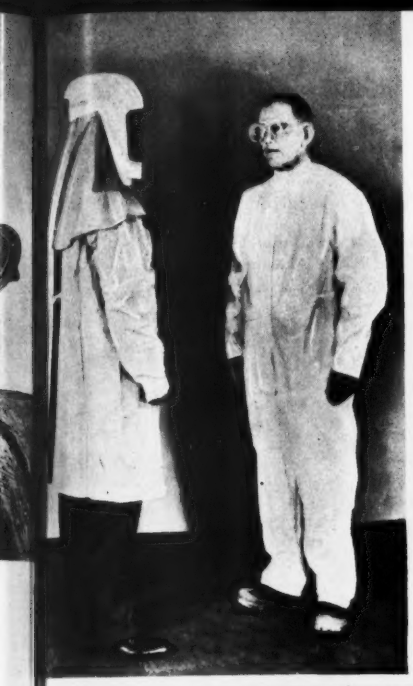


(Below) Tanks for corrosive chemicals are provided with a 1/16-in. hard p.v.c. lining by Dunlop Rubber Co., Ltd., General Rubber Goods Division.

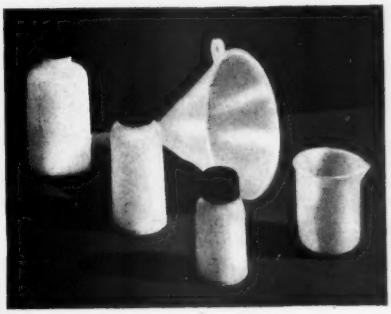


(Right) Centrifuge basket completely covered with "Vulcoferran" by Nordac, Ltd.





(Left) Protective clothing and helmet made by R.F.D. Co., Ltd. The coat and the suit are cotton, proofed on both sides with p.v.c. The double-sewn seams are sealed with a corrosion-resisting film.



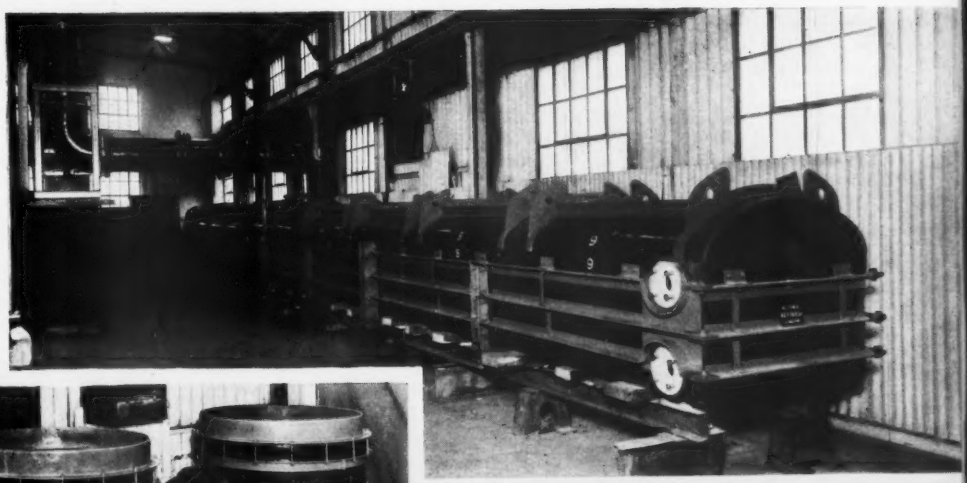
(Above) "Telcothene" polythene material is used by Telegraph Construction and Maintenance Co., Ltd. to mould bottles, beakers and funnels for chemical laboratories.

(Above) Protective clothing, manufactured by Plysu Products Ltd. from p.v.c. sheeting, in use during the production of a special penicillin preparation. (Photo: Courtesy of Glaxo Laboratories, Ltd.)

(Right) Gutta percha has been employed for many years in the manufacture of acid-resisting bottles and apparatus. This group of containers is manufactured by Telegraph Construction and Maintenance Co., Ltd. for use with hydrofluoric acid.

(Left) Conduit systems for corrosive chemicals can be constructed from extruded tubing made from "Telcothene" polythene compounds produced by the Telegraph Construction and Maintenance Co., Ltd.

(Right) "Keebush" acid-resistant material based on phenolic resin is manufactured by Kestner Evaporator and Engineering Co., Ltd., and used in the construction of chemical plant, such as this 60-ft. long strip pickling tank fitted with "Keebush" fume removal ducting incorporating a 24-in. axial-flow fan.



(Below) This set of chlorine coolers is also manufactured from "Keebush" by Kestner Evaporator and Engineering Co., Ltd.

(Right) Protective overgloves are made by Plysu Products Ltd., from p.v.c. sheeting supplied by Greenwich Leathercloth Co., Ltd. These gloves (Prov. Pat.: 21304/51) are especially useful as they also give weather protection for outdoor workers.

Proposal for Establishing Certified Injection Moulding Machine Specifications

By DAVID J. SLOANE

This paper, by Mr. D. J. Sloane, of Lester Engineering Inc., Cleveland, Ohio, was awarded First Prize in the 1951 S.P.E. Prize Paper Contest. It is printed here by kind permission of the Society of Plastics Engineers Inc., Athens, Ohio.

AN injection-moulding machine is two things, a system for clamping moulds and a system for melting thermoplastics and forcing them into the moulds.

An injection-moulding machine should have two basic specifications which accurately describe these features, but throughout the moulding industry there is no general agreement as to the meaning of the specifications, with the result that they are generally misunderstood and frequently misapplied. Their relationship to one another is a subtlety appreciated only by a minority of moulders and their importance, while emphasized in academic discussions, is ignored on the practical operating level.

It is my purpose in writing this paper to draw attention to the need for precise methods of arriving at both of these specifications, methods which can be applied by all members of the industry, widely understood, and agreed upon generally as a basis for using and comparing injection-moulding machinery.

To that end I intend to describe two relatively simple tests which can be applied to commercial injection-moulding equipment to bring all types to a common standard of comparison, so that moulders, in using their equipment, will do so with confidence that their experience with one type of equipment can be related to other types of equipment with a higher degree of accuracy than is possible to-day. In our present state of development this condition does not exist. And worse than being an inconvenience, this complete lack of uniformity in methods of rating clamping and melting capacity has been a serious handicap to thermoplastic technology in the sense that technicians in the industry have made many judgments and come to many prejudices on the basis of erroneous ratings of clamping capacity versus indeterminate ratings in plasticizing capacity.

Finally, it is my purpose to suggest a method by which the industry, aroused to interest in the problem, can insure that these tests, or others perhaps more precise, will be accepted as the basis for **certified** standards.

Beginning first with plasticizing capacity, consider the problem of a project engineer assigned to purchase a machine to produce a disc 13 ins. in diameter, 134 sq. ins. in projected area, .100 thick, 13.4 cu. ins. of moulded material, from 26 cu. ins. of granular material, 8.2 oz. of polystyrene or 10 oz. of acetate.

Generally, the man would be inclined to consider a 12-oz. machine for the job. (Unless he happens to be susceptible to advertising, in which case he might choose a 4- or 8-oz. machine.) To begin with, "12-oz. machine" is a misnomer in itself because it has never been settled of which material it is 12 oz. In passing, it would seem far more useful to indicate "cubic inches of effective injection plunger displacement" so that a moulder could ignore varying bulk factors and specific gravities of different thermoplastic formulations and always know that so many cubic inches of the granule to be moulded can be fed and displaced by the machine under consideration.

The project engineer examines a 12-oz. specification sheet and concludes that his discs per hour depend almost entirely on one specification which is listed "plasticizing rate, lb. per hour":—

Machine A	.....(acetate)	80 lb.
Machine B	.....	*
Machine C	.....	70 lb.
Machine D	.....	90 lb.
Machine E	.....	130 lb.

and in small print "dependent on mould construction and moulding material," which says in effect, "please ignore the foregoing."

If the man is inexperienced, and this has happened many times, he can reasonably assume that his production rate is figured by dividing the plasticizing rate by the weight of his piece, ½ lb. in this case. His figures would be tabulated as follows:—

		Lb. per Hr./Part Wt.	Shots per Hour.	Seconds, Overall Cycle.
Machine A	...	80÷½	160	22½
Machine B	...	*		
Machine C	...	70÷½	140	26
Machine D	...	90÷½	180	20
Machine E	...	130÷½	260	14

Experienced moulders know that competitive plasticizing rates cannot be compared because they are not calculated or estimated by uniform standards. And, in fact, experienced moulders know that the present so-called specification is absolutely without value in practice. Machinery manufacturers are in a dilemma too. If they show the plasticizing rate as a conservative figure (as it would please them very much to do), they put themselves at a serious sales disadvantage, because many jobs can be run faster than they claim. If they rate their machines on the high side, then they are inviting their customers into bitterly expensive errors in estimating, because many jobs cannot approach the fastest moulding rates.

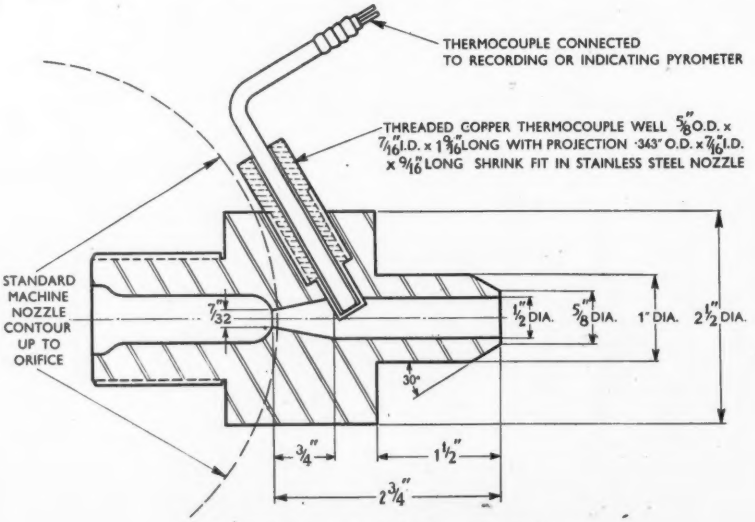

THERMOCOUPLE CONNECTED TO RECORDING OR INDICATING PYROMETER
THREADED COPPER THERMOCOUPLE WELL 5/8" O.D. x 7/16" I.D. x 1 9/16" LONG WITH PROJECTION .343" O.D. x 7/16" I.D. x 9/16" LONG SHRINK FIT IN STAINLESS STEEL NOZZLE
STANDARD MACHINE NOZZLE CONTOUR UP TO ORIFICE
7/32"
1/2" DIA.
5/8" DIA.
1" DIA.
2 1/2" DIA.
30°
3/4"
1 1/2"
2 3/4"

Fig. 1.—Temperature indicating test nozzle.

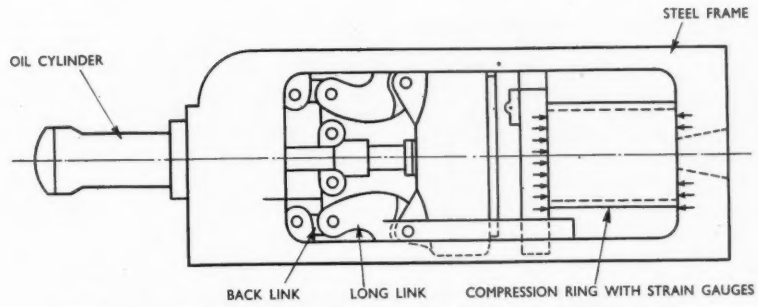


Fig. 2.—Test ring in toggle clamping assembly of injection moulding machine.

The conclusion is that, in its present form, " plasticizing rate " is trying to be a one-word description of a machine characteristic which requires a volume to describe completely. For this reason, one manufacturer has replaced the number with an asterisk.

Plasticizing Rate

Plasticizing rate is intended as a measure of how fast the melting system can soften the thermoplastic to a flowable condition. Thremoplastics vary, one from the other, very greatly in all the characteristics that determine this melting rate, so that plasticizing rate must immediately be related to one type of material, selected as standard. Thermoplastics have varying degrees of flowability, so that, depending on the particular mould in question, the one material formulation selected as standard would be flowable at temperatures within a range of approximately 150 degrees F. A thin section with long flow would require the hot extreme of flowability, while a heavy-section short flow would require the low extreme. Naturally, the plasticizing rate would vary in each case; just as it would as a result of differences in moulding standards. Where fine quality is demanded, as against casual quality standards, the plasticizing rate in terms of hourly production would be lowered.

The contradiction in " plasticizing rate " is the fact that machinery builders have tried to estimate an average " production rate " for jobs which they have never seen. This is no specification. In the past it has been more like the tabulation of a ouija board.

Instead, I would propose the acceptance of a standard temperature indicating or recording nozzle as shown in Fig. 1, which would be applied in turn to each of the commercial machines offered for sale.

The one material formulation and colour, presumably a polystyrene, which was sold in the greatest quantity in 1951, would arbitrarily be selected as the basis of comparison.

Proposed Method

The method proposed is to set all pyrometers at their optimum setting (600 degrees F. is one recommendation), and purge the machine into the air through the test nozzle. When the material passing the nozzle shows a uniform reading of 400 degrees F. and the machine cycle has been reduced to a minimum, the output of the machine for half an hour can be collected and weighed and the result tabulated as the melting rate of the machine being tested. My own experience with this test, as well as the experience of others, has shown that, where the cycle is set too fast, the temperature of the material leaving the nozzle will drop below the required value. A further requirement would be that the machine be set to feed its rated capacity, whatever it might be in the material specified.

The test nozzle illustrated in Fig. 1 was designed to give a standard orifice size of 7/32 in. at the end of the conventional nozzle for a particular machine. The part beyond this orifice toward the outlet end of the nozzle was designed to permit the material to continue in a uniform stream at low pressure past the copper thermocouple well into a relatively long flow channel, from which it can easily be collected into a container. The problem of erosion and leaking at the point of thermocouple entrance is very slight because the pressure of the material is released once it has passed the orifice and the nozzle is used only for testing rather than for production purposes. If the thermocouple is connected to a recording pyrometer, then it would be possible for the machine test to be recorded and filed with the agency which finally sponsors the test.

Sponsor Group

The tests might bear the name of the group which sponsors it, whether it be the Society of Plastics Engineers, the Society of the Plastics Industry, the American Society for Testing Materials, or the Joint Industry Conference. With this sponsorship it would only be a matter of time before the capacities of commercial machines were common knowledge. Each machine would be recognized to be capable of melting a definite poundage of the selected material per hour to 400 degrees F. Other materials would be delivered in proportionately greater or lesser amounts, depending on their thermal conductivity, heat stability, specific heat, and flow characteristics, compared to the standard material. The method of introducing these tests to the industry will be discussed at the end of this paper. For the present, let it suffice that this is a simple and inexpensive start toward bringing this one specification into a condition that plastics engineers can use and compare with confidence that they are talking the same language.

The other specification, clamping tonnage, is in an equally nebulous condition. Its importance is at least equal to the first. Clamping capacity is a machine factor which, if misapplied, can result in critical financial losses both from overweight in the mouldings and machine maintenance.

Clamping Types

First it is worth noting that the two basic clamping designs have certain important differences. A hydraulic clamp will build up a certain locking tonnage which it can sustain without backing up. When that tonnage is reached in the mould, the machine blows open and keeps moving back until it has relieved the mould pressure by flashing and the plunger has bottomed. In contrast, the toggle-type lock builds up a certain locking pressure which it can sustain without backing up. When that amount of force is applied in the cavity, the mould begins to back up, but as it does, the toggles are put under greater compression than the original lock created and the bars or frame are put under greater tension, so that the mould parting is resisted with a proportionately greater force as the mould backs up. The point of the difference is that a hydraulic clamp has a precise point at which it is completely overloaded and therefore a precise clamping tonnage, whereas a toggle clamp has a range of overload in which many jobs can still be held and moulded.

It is worth noting at this point the factors which make up the force that blows open the clamping system. If molten thermoplastic were a liquid, an injection moulding machine would be a mould holder in combination with a pouring spout, a moulding process very much to be desired and perhaps some day even to be realized. The mould would fill by gravity and the expensive and complicated clamping ends would be obsolete. For the present, however, this is only a fantasy, and the fact is that in molten condition, thermoplastics are a rapidly chilling taffy, rather than an easy flowing liquid. Therefore the moulds will not fill completely except when the thermoplastic is forced in at high pressure.

Effective Pressure

Conventional moulding machines at present have settled at an injection

pressure of approximately 20,000 lb. per square inch at the plunger tip as an appropriate injection pressure for the general run of moulding jobs. Applying Pascal's law, that gives a pressure in the mould, at the instant that the injection plunger comes to a stop in the forward position, of 10 tons to the sq. in. If this pressure were applied on a fluid, it would be transferred undiminished to every crevice of the mould. As it happens, it is applied on a rapidly cooling thermoplastic which varies in consistency, depending on the material and the heat, from a fluid to a taffy. Tests conducted in the Dow Chemical Co. laboratory and described in articles in issues of "Modern Plastics," April, 1950, and April, 1951, indicated that a material section of 0.170 in. gave an effective pressure in the mould equal to 30 per cent. to 65 per cent. of the plunger tip pressure of 10 tons to the sq. in. depending on the stock temperature. On thinner sections it is reasonable to assume that this percentage (if not reduced) is effective for a shorter interval and therefore can be considered to be, and is, as little, but no less than 30 per cent. of the plunger tip pressure.

With these figures in mind, it is apparent that the 134 sq. in. disc which our imaginary project engineer has to mould will exert a separating force in the mould of 134 sq. ins. times 10 tons to the sq. in. times approximately 30 per cent. The clamping force required is therefore 390 tons when the stock temperature is held at a moderate level. On those occasions when the pyrometer permits an override or the operator allows a delay between cycles, the clamping force necessary might rise from 390 tons to 650 tons. Referring to the clamping specifications of the leading manufacturers of 12-oz. equipment:

	Rated Casting Area in Mould, sq. ins.	Clamping Tonnage.
Machine A	110	275
Machine B	110	350
Machine C	—	275
Machine D	110	300
Machine E	—	400

These tonnage ratings, though arrived at now by individual and unrelated methods, could be a specification, but the casting area recommendation falls into the realm of the swami as the plasticizing rate does. It represents an imaginary job and a suggestion which does more harm than good to the engineer trying to apply it. My own opinion is that if the industry accepted a uniform method of calculating and testing clamping pressure, there would be no reason to show recommended projected areas.

The following is a method of checking machine clamping which was developed in co-operation with Prof. D. K. Wright, Case Institute of Technology, and which again is simple and direct. The method

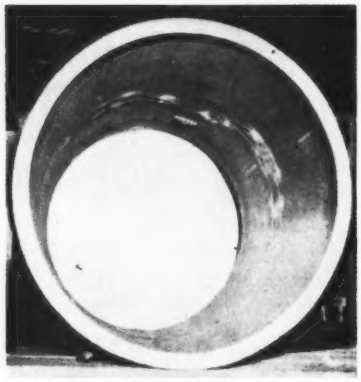


Fig. 3.—Test ring with strain gauges installed.

involved is to take strain gauge readings from a compression ring placed in the centre line of a machine and loaded to the utmost capacity of the clamping end of the machine. In the case of the hydraulic end, this is the point of maximum pressure setting. In the case of the toggle machine, this is the stalling point. The ring is sized to fit as many of the standard machines as possible and where necessary spacer plates can be used to accommodate it. (Three rings for three clamping ranges would suffice for all equipment.) The ring is sized to give a deflection of an order which can be read by strain gauge equipment at the most sensitive part of its scale. The ring would be taken to an engineering college where eight SR4-type C1 Baldwin strain gauges would be mounted on the inside of the ring at 90-degree intervals, four mounted parallel to the axis of the ring, four along a circumference. The four axial gauges are connected in series as are the circumferential gauges, forming respectively the active and compensating legs of an ordinary Wheatstone Bridge circuit. All readings and calibrations are made with a Baldwin SR4 strain indicator.

With the strain gauges in place, the ring is placed in a universal testing machine (Baldwin-Southwark or similar) and calibrated for various compression loads in the range of the machines to be checked. With this information tabulated, it is a simple matter to install the test ring in the machine to be checked and interpret the compressive deflection of the ring as read through the strain gauges, relating it directly to the known readings of the testing machine for the same deflection.

This method of testing has already been used by the writer on both toggle and straight hydraulic locking ends with success. Fig. 2 illustrates the testing ring installed in a machine. Fig. 3 shows the strain gauges in place in a test ring.

So much for the two tests which, in my judgment, are adequate for an excellent beginning. Unfortunately there has never been a group in the industry whose vital interest or enlightened self-interest demanded these types of certified ratings, as they are demanded in some other industries. This industry has never been "scientific" at the production level to the point where operators and moulders recognize the need or lack of these certified specifications. There has been much travail and hardship as a result of the discrepancies noted, with attendant losses of great amounts of money, but no group of sufficient unity and strength ever campaigned for these standards. Unless part of industry demands them as a prerequisite to purchasing machines, the machinery manufacturers have no important motive for working the ratings out among themselves.

J.I.C. Standards

There is in the industry one group whose association for another purpose has brought some very excellent changes in the hydraulic circuits and electrical circuits of plastics and die casting equipment. The J.I.C. standards in the automotive industry are now universally recognized and observed by all manufacturers who solicit machinery sales from this group. If this same group, or even the General Motors' plastics technical group insisted on these certified ratings as part of their guarantee in purchasing injection moulding machinery, the machinery builders would be obliged to carry out either these suggestions or others which may be better.

As a group, the manufacturers of machinery are reputable and once the standards were accepted in the industry there would be no reason to police the tests. Each manufacturer, in co-operation with some engineering college, could work out their own nozzle and rings according to the test requirements and publish their own data. The tests are simple and inexpensive enough to be carried out in the field by any interested customers and the likelihood that this would happen would be all the restraint necessary to ensure the correctness of the published data.

The Society of the Plastics Industry or the Society of Plastics Engineers could encourage this trend with publicity, but they could not drive the point home alone because they don't have the bludgeon of huge sales with which to make their request heard as the two groups listed above do have. Initially, these ratings would be confidential for the use of the sponsoring purchasing group until all specification sheets could be revised to conform, but eventually we could anticipate that all specification sheets would be published with these two specifications, melting capacity and clamping capacity certified according to J.I.C. or G.M. standards, to the very great benefit of thermoplastic technology and plastic engineering.

Mechanical Properties of Plastics

The following papers were presented at a symposium on "The Mechanical Properties of Plastics" held in London on March 7, by the Plastics and Polymer Group of the Society of Chemical Industry. The opening remarks by Dr. N. J. L. Megson are referred to on page 87.

Physical Evaluation of Small Samples of Plastics

By K. H. C. Bessant, Mrs. M. G. Dilke, C. E. Hollis and J. J. Millane

TESTS suitable for the rapid assessment of the mechanical properties of 5 to 50 gm. experimental samples of (a) hard thermoplastics and (b) elastomers were described.

For thermoplastics of type (a), e.g. polystyrene, impact strengths are determined by a Charpy-type test on notched square-sectioned bars of dimensions 4 by 0.3 by 0.3 cm., cut from plates showing no optical strain moulded at 180 degrees under 5,000 p.s.i. pressure for five minutes in a simple flash mould. For polystyrene-like materials, the standard error of the determination for five specimens (about 5 gm.) is ~5 per cent of the mean value. Softening points are characterized by a dilatometric determination of the apparent second order transition temperature (T_m) on 0.2 gm. samples, carefully freed from volatile matter: T_m values are reproducible to within ±1.5 degrees. Flow characteristics are readily compared using an Atkinson-Nancarrow plastometer, about 40 gm. of material being needed. Test data on various polystyrenes and styrene copolymers are given to illustrate the use of the methods.

The tests used for elastomers apply in particular to plasticized polyvinyl chloride and are hence used for assessing a series of polymers (using a standard plasticizer) or a series of plasticizers (using a standard polymer); they may also be applied to other polymers, e.g., poly (methyl acrylate).

Tensile strength and elongation at break are satisfactorily measured on 2-in. dumbbell specimens cut from sheet prepared by milling 10 gm. polymer, 5 gm. plasticizer and 0.07 gm. white lead on a 4-in. by 2-in. diameter roller mill at 140 degrees; if attention is paid to the control of roll temperature, the results are statistically indistinguishable from those obtained from sheets milled on a larger mill using ten times the quantity of material. In the case of paste mixes, the paste (20 gm.) is mixed in a laboratory end runner mill, de-aerated, and gelled in three 4.5-in. by 1-in. by 0.020-in. cavities in a stainless steel plate with flat cover plate. The temperature of this mould is critical, and is controlled with the aid of a thermocouple, fixed just below the central cavity: heat is supplied by placing the mould between the platens of a laboratory press. The method has been used for investigating paste cures of from 4 to 12 minutes at from 110 degrees to 180 degrees, the standard error for tensile strength (500 to 2,500 p.s.i.) being ±68 p.s.i., using four specimens from a single strip.

B.S. Hardness is measured in the usual way on specimens prepared by laminating pieces of sheet prepared as above: a five-day conditioning period is required before test. Brittle temperatures are characterized by refractometric determination of T_m on thin films of plasticized material, using an Abbe refractometer with cooled prisms. Resilience may be examined by employing an apparatus similar to a Dunlop tripsometer, using a 1 by 1 by 0.4 cm. specimen in a holder which may be held at any temperature between ±40 degrees. Resilience/temperature curves (showing the usual minima) for the systems polyvinyl chloride/tricresyl phosphate and polyvinyl chloride/di(2-ethylhexyl) phthalate, agree well with those of previous workers. A small glass apparatus for determination of plasticizer loss from plasticized specimens in an air stream at 100 degrees C. was described.

The success of these methods, none of them new in principle, demonstrates that it is possible to test much smaller quantities of materials than may previously have been recognized, with reproducibility sufficient for making significant comparisons between laboratory samples.

Interpretation of Mechanical Tests of Plastics

By C. G. Evans and H. Warburton Hall

THE properties of a material in which the aircraft designer is first interested are strength and stiffness in tension, compression and shear. This paper discusses only these together with impact strength. The many tests devised for specification purposes are not considered. Normally a design is not investigated for fatigue, impact and toughness until the strength and stiffness criteria have been satisfied.

Most structural plastics consist of fibre reinforced resins and it is observed that where bonding between the constituents is good the strength and stiffness are derived from the fibre, but as the bonding deteriorates the mechanical properties approximate more closely to those of the resin. The properties of composite materials may be predicted from those of their constituents and mechanical tests will demonstrate the efficiency with which they have been used.

Care is necessary in designing tests to ensure that only the type of stress required is introduced into the working section of the test piece and test pieces themselves must be carefully made to avoid introduction of faults which cause stress concentrations or partial failure of the material. The use of shear-pin loading in tensile tests is recommended. High scatter in test results may often be traced to the testing procedure or method of manufacture of specimens.

In plastic structural design shear is usually the critical strength property. Because of the difficulty of applying shear in the plane of sheet material, wherever possible, the test piece should be a tube loaded in torsion. This is not practical in many structural plastics, when a panel must be tested. A rig designed to apply equally tension along one diagonal and compression along the other is used. The edge conditions for holding the panel must be clearly understood or the calculated failing stresses will be inaccurate. Notch sensitive materials will usually fail prematurely in a panel test.

Tensile and compression stress/strain curves should be taken to the ultimate stress as the shape of the curve indicates the degrees of fibre-resin interaction and is of importance in computing failing loads where these are an elastic phenomenon.

The four point bending test will give directly the ruling elastic constants for strut and compression panel design.

In aircraft structures the shear modulus is the most important elastic constant as it governs the torsional stiffness. It cannot as yet be determined from a knowledge of the other elastic constants.

The "toughness" although difficult to define is an important property in a structural material and governs the ruggedness of a structure in withstanding fortuitous stresses.

One important factor in toughness is impact strength which is not easily measured in a fundamental way to provide design data. The usual method of test suffers from a number of difficulties (e.g. variation due to test specimen size and shape, speed of impact, etc.), and it is probable that tensile impact would provide more fundamental information than the usual notched cantilever test.

Much can be learnt from an examination of the variation of mechanical strengths and elastic moduli of reinforced plastics with varying fibre contents and lengths and this paper refers to the results of such examinations for combinations of asbestos and cresylic resin.

Some Mechanical Properties of "Perspex"

By Dr. E. A. W. Hoff

THE object of this paper is to demonstrate the complexity of the theory and practice of the testing of thermoplastics, arising from the close interrelation between different properties of these materials. Most mechanical tests are carried out by producing a deformation in a test-piece. The mechanism of deformation in thermoplastics is essentially different from that of other materials, e.g. metals; they show delayed elasticity which arises from the long-chain nature of the large molecules and makes the mechanical properties strongly dependent on temperature and on the rate of testing.

At fast rates of testing the temperature control of specimens becomes inherently difficult since plastics usually show high mechanical losses and possess a low thermal conductivity. A further point is that, as a consequence of the entangled arrangement of the long chains, thermoplastics are often not in thermodynamic equilibrium even if kept for long times at a given temperature; only above certain temperature ranges, one of which is characteristic for each polymer, does the rate of spontaneous chain rearrangement reach experimentally accessible values.

The random entanglement of chains also implies that there is always a certain number of microscopic regions present in which localized stresses or cohesive weaknesses are seated. Thus a minute proportion

of a material can determine the result of a destructive test, e.g., by the initiation of fracture, and introduce a scatter among test results which is not due to experimental error but an intrinsic material property. Many of the points made apply in the first place to amorphous, rather than to crystalline, polymers. For many amorphous polymers it appears to be true that induced deformations are almost fully recoverable and that the similarity of their deformation phenomena to those of metals exhibiting "plastic flow" is only superficial.

It follows that the testing of plastics must be carried out with great attention to detail and to such theoretical knowledge as may be available. This often means that one has to resort to refined experimental techniques and that it is not permissible in many cases simply to take over established metal testing techniques.

The effect of specimen thickness on fatigue test results is explained by severe internal heating, some measured specimen temperatures being adduced in evidence; the influence of the dynamic mechanical behaviour of "Perspex" on fatigue testing conditions is also stressed. Compression tests illustrate that "Perspex" fails essentially in a fashion which would be described as "ductile" in metals; below 45 degrees C. a "Perspex" compression specimen may crack to pieces, but this type of failure originates from a brittle tensile fracture on a portion of the specimen. Above 45 degrees C. "Perspex" shows "necking" in tension; we have called this temperature the "tensile brittle point"; above it tensile fracture no longer occurs in a compression test and the specimens can be "barrelled" almost ad infinitum.

The "ductile" deformation of "Perspex," which superficially resembles plastic flow in metals, is shown to be a high elastic deformation; the specimens are apparently stable at room temperature in their deformed shape, but return fully to their original shape after heating, even if severely deformed. Concerning the time dependence of the static loading strength of "Perspex," the suggestion is made, by way of an explanation of the strong effect found, that microscopic inhomogeneities of the material suffer a particularly large strain relaxation until the molecules come apart locally and a fracture is initiated. The determination of Poisson's Ratio of "Perspex" by Cornu's method and with the help of electrical resistance strain gauges leads to a value of 0.36; the temperature and rate dependence of Poisson's Ratio is probably small.

Impact strengths according to various test methods do not represent intrinsic material properties and are insufficient as a basis on which to compare the physical nature of two different materials; if the impact behaviour of a material is to be fully appraised, the influence of temperature and testing speed has also to be measured and the nature of the fracture obtained as well as the influence of notch shape should be studied.

Izod tests using a standardized notch shape appear to be of little practical value; to judge the behaviour under service conditions of materials a repeated blow dropping weight test is preferred and it is recommended that a 50 per cent. fracture value be quoted in the results, as well as the standard deviation of the distribution of fractures.

Two Extrusion Plastometers for Use With Polyvinyl Chloride

By R. Hayes

SINCE the "flow" properties of plastic materials are of such importance a large number of plastometers have been developed, mainly by the rubber industry. Three main types exist, rotational, extrusion and compression, but in this paper only the extrusion type is considered.

A rubber extrusion plastometer is described by Dillon and Johnson[1] and more recently, in 1944, a plastometer in which the rubber is extruded at a constant rate and the pressure measured has been developed by Kelsey and Dillon.[2] Atkinson and Nancarrow[3] describe a plastometer operating on a similar principle for use with cellulose acetate, cellulose nitrate and polyvinyl chloride, while Nason[4] describes a constant pressure plastometer for use with polystyrene, polyvinyl chloride and cellulose acetate.

One plastometer which has been used by the author as a development and control instrument for rigid and flexible p.v.c. compounds for over four years is a weight-loaded instrument. Material under test is heated in a metal block with an orifice screwed in the base. Pressure is applied to the material through a piston by means of a weight-loaded lever. The lever has an advantage of 10 : 1, the area of the piston is 0.4 sq. in. and the normal practical range of pressures used is from 250 to 3,000 lb./sq. in. The time taken to extrude a standard volume through an orifice $\frac{1}{16}$ in. diameter and $\frac{1}{8}$ in. long under various pressures is measured. The flow time/pressure curve is plotted and the pressure required to extrude the material at a rate of 0.84 cu. ins. per minute is taken as an index of the flow or plasticity of the material.

A disadvantage of the instrument is that four or five pressure/flow time determinations, taking from one to one-and-a-quarter hours are required to get an index of the flow of a material. This time is reduced in control work when the characteristics of the material under test are known. The lifting of heavy weights by the operator is a second disadvantage.

Because of these drawbacks a self-indicating plastometer was designed. In principle, it is similar to those described by Kelsey and Dillon[2] and Atkinson and Nancarrow.[3] A cylinder with an orifice screwed in the base fits into a heated block. The block is supported on a pressure capsule and when a piston, driven down at a constant speed, extrudes the material through the orifice, the pressure developed is recorded by means of a pressure gauge fitted to the pressure capsule. Since this plastometer has been designed mainly for plant control work it is fitted for only one rate of extrusion. A number of cylinders and orifices have been made and by preheating in a separate oven and then placing in the heated block it is intended that a large number of flow determinations be made in a short time.

Using a piston area 0.5 sq. in., the maximum pressure measurable at the moment is 4,000 lb./sq. in. The pressure capsule is capable of withstanding considerably greater loads and by using a larger gauge the pressure range can be increased. As at present used, the instrument can measure the flow or plasticity of p.v.c. compounds ranging from unplasticized Geon 101 and Geon 202 to compounds with a plasticizer content of 50 per cent. total weight. Graphs of these results were shown.

Both plastometers described are of an empirical nature, designed to give comparative results for development and factory control work. The weight-loaded instrument while having some disadvantages in operation is simple in construction, whereas the second instrument is of more complex design but has the advantage that it is self-indicating.

(1) *J. H. Dillon and N. Johnson. Physics*, 1933/**4**/225. (2) *R. H. Kelsey and J. H. Dillon. App. Physics*, 1944/**15**/352. (3) *E. B. Atkinson and H. A. Nancarrow. Proc. Internat. Rheological Cong.*, 1948, *Part* 2, *p.* 103. (4) *H. K. Nason. J. App. Physics*, 1950/**1**/113.

Indentation Testing of Phenolic Mouldings by Brinell and Hot Needle Methods

By J. H. Bennitt and C. E. Avenell

AN indentation test on a thermosetting moulding can be made quickly and accurately without leaving more than a slight mark or doing other damage. There is no lack of test methods and numerous results have been published, but practical interpretation of the test results has received only limited attention. The most frequent inquiry, not directed particularly to thermosetting mouldings, as to the relation between indentation results and resistance to abrasion has led to the conclusion that there is no direct relation between the two. There seem, however, to be some practical uses of this rather convenient test. Results were interpreted for two kinds of indentation test using respectively a cold spherical ball and a hot needle with a radiused point.

Cold Ball Indentation Tests

The results described were obtained from the familiar Brinell test, which estimates hardness from the indentation produced by a steel ball under load.

The composition of phenolic mouldings may be reflected by significant differences in the Brinell hardness, and this is sometimes a convenient way of checking that supposedly similar mouldings have in fact a similar composition. If the test results are significantly different the first assumption may be that they have different compositions.

For degree of cure small differences are not reflected by differences in Brinell hardness. Grossly undercured mouldings give a low hardness, and in some cases prolonged overcure leads to a slight decrease over that obtained for normal cure. Incorrect moulding can sometimes be detected by a low hardness figure.

In one case low figures were reported for mouldings which were showing frequent failures in a bearing application, although all had normal dimensions and appearance. It was found that, owing to a difficulty in loading the mould, all the mouldings with low hardness were low in weight due to porosity. It was concluded that their lack of wear resistance was associated with their low hardness, due to a porous structure caused by incomplete filling of the mould, and that measurement of hardness would allow detection of mouldings likely to fail in service.

The chemical resistance of mouldings can be followed by measuring changes in hardness. Thus there was a direct relation

(*Continued on page* 110.)

New Productions

Edge-lit Instrument Dials

The fact that the novel A.C. Sphinx transparent dials for Vauxhall cars are edge-lit presented special problems to E. K. Cole, Ltd., Plastics Division, who are moulding the components in "Diakon."

These dials are calibrated in deep relief on the back and filled white; at night, the edge lighting gives the markings a vivid three-dimensional effect. A high degree of flatness is necessary, however, to prevent uneven refraction and the markings must be deep and clear cut; other essentials are perfect clarity and freedom from weld-lines. The dials, which are produced four on a sprue, are therefore fed by heavy runners, to minimize the possibility of weld-lines occurring, and the individual dials, having been removed from the sprue, are masked by a rapid process and sprayed with the white colour. A special polishing technique is then employed, which avoids softening the outlines of the markings, and does not disturb the white filler.

"Diakon" was chosen as moulding material for its resistance to attack from hydrocarbons.

Three-position Switch

Arcolectric (Switches), Ltd., Central Avenue, West Molesey, have designed a new three-position toggle switch with which each position is readily obtained with a positive snap. The switch is provided with six terminals for connection and will switch three separate single-pole circuits; alternatively, it can be used to control two circuits, and either the end or central position can be "off" positions. The contacts are of the self-cleaning low-resistance type, and the switch is rated 5 amps. 250 volts A.C./D.C. Applications include switching electric motors to give two speeds and "off," and controlling electric elements to give two heats and "off." The plastics components include two phenolic mouldings and a covering plate cut from laminate.

Spotlight Screwdriver

Mending fuses and similar electrical repair jobs, which must be carried out without electric light from mains supply, is made easier by the Spotlight screwdriver produced by Spot Tools (London), Ltd. This instrument incorporates a battery-operated electric torch in the handle, the blade being set in a transparent "Diakon" moulding, which also acts as a lens to focus a small beam of light simultaneously on the tip of the screw blade and on the job. The Spotlight screwdriver, which also incorporates an injection-moulded cellulose acetate end cap, is distributed for the manufacturers by John E. Buck and Co., 47, Brewer Street, London, W.1.

Glass-washing Machine

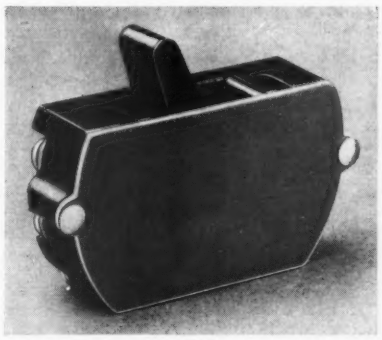
The Hoover "Glassmaster" is an electrically operated bar-fitting which washes and sterilizes all types of glasses. It is self-contained, readily fitted to an existing counter, and supplies a constant stream of clean glasses at rates up to 1,500 an hour if required. Its interest to readers of "Plastics" is that it is provided with an illuminated "Perspex" hood. The dirty glasses are placed on a receiving tray from which they are carried by a built-in conveyor through powerful jets that swirl each glass inside and out—first with hot water, then a sterilizing mixture, and finally with cold water.

Postmen's Clothes

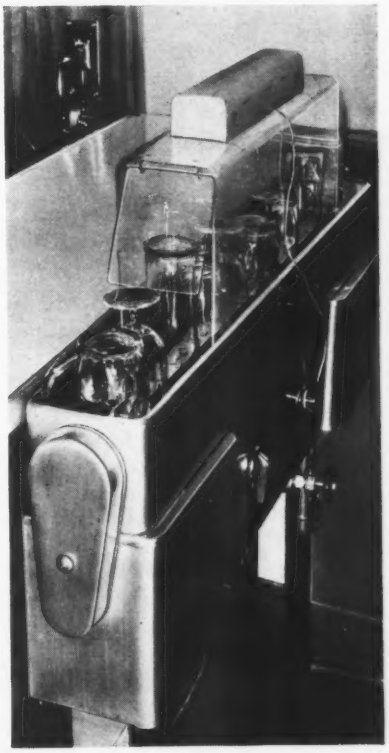
A joint study group of officials and staff representatives has for some time been considering improvements of the various items of clothing which the Post Office supplies to its postal staff. In order to make this clothing last longer in good condition, new types of material are being examined, with the substitution of a plastic-dressed waterproof coat for the cape which is now issued to postmen.

"Cinemoid Wireweld."

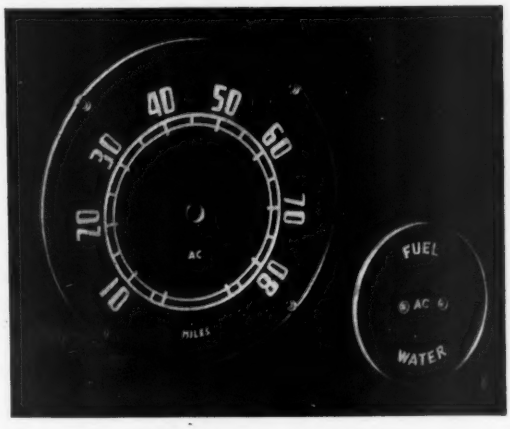
Referring to our notice of name signs recently erected at a London store ("Plastics," March, 1952, page 76), British Celanese, Ltd., inform us that the material from which these signs are fabricated is correctly known as "Cinemoid Wireweld," this being a registered trade mark.



Three-position switch.



Glass-washing machine.



Edge-lit instrument dials.

Spotlight screwdriver.

PRODUCTION NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes

FORK TRUCK.—Our illustration shows the 6-20 fork truck made by Conveyancer Fork Trucks, Ltd., Liverpool Road, Warrington. This model is a 6,000-lb. capacity machine at 20 ins. load centres from the heel of the forks, with alternative power unit of petrol or Diesel engine operating to nine miles per hour on level ground and up a gradient of 12 per cent. The outstanding feature of this truck is its fully automatic hydraulic drive. Having no clutch, the engine torque is transmitted through a hydraulic turbo-drive and automatic gearing. The turbo drive is a simplified version of one which has already seen several years of heavy duty tractor service.

GAUGE AND TOOL MAKERS' ASSOCIATION.—The Association's second Competition in Craftsmanship and Draughtsmanship, takes place in May in conjunction with the 1952 British Industries Fair. Entries by apprentices with member firms are more than double the number received for the first of these competitions in May, 1951.

TOOL STEELS.—Richd. W. Carr and Co., Ltd., Wadsley Bridge, Sheffield 6, inform us that they have now terminated their agency agreement with Brooks and Walker, Ltd., 41, Dockhead, London, S.E.1, for the sale of "Motor" brand fine tool steels and engineers' small tools for the area of London and Home Counties. This area is now being worked from their own branch office at 38, Coram Street, London, W.C.1, and is under the supervision of Mr. J. Leavesley Buxton, sales director.

POLYTHENE PLANT. — Canadian Industries, Ltd., has announced its decision to build at Edmonton, Alta., a plant to manufacture polythene. The plant will cost about 13 million Canadian dollars, and will employ 200 persons. Both I.C.I. and Du Pont are major stockholders in Canadian Industries, Ltd. The initial production of the new plant will be 6,000 tons per year, which is more than eight times the amount of polythene flake at present imported by Canada from the U.K. and U.S.A. The necessary ethylene will be obtained by the dehydrogenation of ethane derived from 10 million cubic ft. of natural gas per day.

CHEMICAL ENGINEERING CONVENTION.—A European Convention of Chemical Engineering will be held in Frankfurt/Main on May 18-25. This Convention is being arranged jointly by the Dechema. "Deutsche Gesellschaft für chemisches Apparatewesen E.V.," and the "Société de Chimie Industrielle, Paris," in connection with the Achema X, the 10th Chemical Engineering and Appliance Exhibition. Notification of participation in the Congress should be made to the Dechema, Frankfurt/Main, 13 P.O. Box 1337.

INDUSTRIAL SELF-HELP SCHEME.—Industrial representatives in areas containing a number of important factories are being invited by the Ministry of Supply to form small self-help panels prepared to assist each other with labour, materials, plant and any other facilities they may have available in the event of damage occurring in wartime. It is considered that factories engaged on important war work should themselves introduce and operate a voluntary system of self-help, and should be able to provide immediate first aid from their own resources to get factories back into production as quickly as possible.

BOAKE, ROBERTS AND CO., LTD., inform us that the selling prices of the following solvents have been reduced with effect from March 3, 1952:—

Butyl alcohol decreased by £45 per ton.
Butyl acetate decreased by £40 per ton.
Isopropyl acetate decreased by £10 per ton.

Resulting upon the reduced cost of butyl alcohol, they are reducing the selling prices for 1-ton lots of tributyl citrate, butyl lactate, butyl oleate, butyl stearate and dibutyl tartrate.

BRITISH INDUSTRIAL SOLVENTS, LTD., announce that the following changes in the price of certain "Bisol" solvents and plasticizers took effect on March 3, 1952: n-butyl alcohol, £206 per ton; n-butyl acetate, £224 per ton; isopropyl acetate, £149 per ton; dimethyl phthalate, 2s. 2d. per lb.; diethyl phthalate, 2s. 6½d. per lb.; dibutyl phthalate, 2s. 8½d. per lb.

D.O.P. type phthalates: Bisoflex 791, 2s. 10¾d. per lb.; Bisoflex 81, 3s. 2¾d. per lb.; Bisoflex 82, 3s. 0¾d. per lb.; Bisoflex 91, 2s. 10¾d. per lb.

In consequence of the reduction in the price of n-butyl alcohol, the prices for n-butyl lactate, n-butyl laurate, n-butyl oleate, n-butyl stearate, dibutyl ether, dibutyl oxalate, dibutyl tartrate and tributyl citrate, were reduced with effect from March 4.

The following price changes became effective on March 6: Diacetin, £397 per ton; Triacetin, £370 per ton.

All the above prices are for 1-ton lots, carriage paid, in packages returnable at seller's expense.

"LUSTREX." — Monsanto Chemicals, Ltd., Victoria Station House, Victoria Street, S.W.1, inform us that as from March 1, 1952, the price of "Lustrex" has been reduced to 2s. 10d. per lb. for clear crystal, and 3s. 1d. per lb. for colours, delivered, packed in 50-lb. five-ply paper bags, in a minimum quantity of 500 lb.

The reduction in price announced is substantial, and we are informed by Monsanto that it has been made in the hope of providing an incentive to develop new uses and also to bring the domestic market into line with overseas markets where, for some time, polystyrene has been available at a lower price. It is not expected that any further price reduction will become possible within the predictable future and, as supply and demand are now fairly balanced, there should be no further interest in high-priced "grey-market" material.

HANOVER FAIR.—The 1952 Heavy Industries Fair at Hanover, April 27 to May 6, will include a special section devoted to the plastics industry. To facilitate contact with foreign business friends the "Verband der Chemischen Industrie, Frankfurt/Main" and the "Arbeitsgemeinschaft Deutsche Kunststoffindustrie, Frankfurt/Main" will have their own information stalls.

BRITISH INDUSTRIAL PLASTICS, LTD.—The directors' report for the year ended September 30, 1951, shows a net profit of £84,957. With a balance of £123,702 brought forward from last year, available profits amount to £208,659. A final dividend of 10 per cent. less tax, is proposed on the ordinary shares, making 20 per cent, less tax, for the year. The balance to be carried forward is £133,058. A bonus of ½d. per share, free of tax, on the ordinary shares is also recommended.

In his statement, circulated with the report and accounts, Mr. Kenneth M. Chance, chairman of the company, points out that the company is probably the largest consumer of urea in this country, and certainly one of the largest consumers of formaldehyde. When the new factory at Oldbury is completed it should become the largest consumer of melamine. He also draws attention to the increase in price for first-grade "Beetle" moulding powder which became necessary on January 1 and August 1 during the year under review, pointing out that even now its price only exceeds the basic pre-war price by less than 40 per cent. The following figures, he adds, speak for themselves:—

Cost Sept., 1939			Cost Sept., 1951
100	..	Urea	112
100	..	Formaldehyde	128
100	..	Hired transport.. ..	233
100	..	Packages	287
100	..	Boiler slack	300
100	..	Wood-pulp	595
100	..	Zinc oxide	918
			Aug., 1951
100	..	Basic selling price of first-grade "Beetle" powder, containing about 30 per cent. wood-pulp	139.4

ROBERT McARD AND CO., LTD.—The report of the directors for the year ended December 31, 1951, draws attention to a marked increase in trading profits at £64,747, due to increased turnover which so far during 1952 is being maintained. A final dividend of 30 per cent. (less tax) is recommended, making the total dividend for the year 50 per cent. (less tax). The balance carried forward is £30,628.

Private Account Imports of Moulding Powders. Board of Trade—Plastics Materials Section.

	Country of Origin	Licences issued Nov., 1951	Arrivals Nov., 1951	Licences issued Dec., 1951	Arrivals Dec., 1951	Licences issued Jan., 1952	Arrivals Jan., 1952
		tons	tons	tons	tons	tons	tons
Phenol and/or cresol forma'dehyde	U.S.A.	0.4	—	—	0.9	8.85	8.85
Phenol and/or cresol formaldehyde	Germany(W)	—	59.7	—	50	—	83.6
Phenol and/or cresol formaldehyde	France	—	—	—	10.55	—	0.05
Phenol and/or cresol formaldehyde	Canada	—	—	—	—	—	—
Cellulose acetate butyrate	U.S.A.	24.7	2.45	22.6	1	8.05	27.2
Cellulose acetate butyrate	Germany(W)	—	—	—	—	—	—
Cellulose acetate	France	—	—	—	—	—	—
Polystyrene	U.S.A.	0.25	—	10.25	0.9	—	71.3
Polystyrene	Canada	13.4	207.65	—	124.5	—	49.1
Polystyrene	Germany(W)	—	—	—	—	—	—
	Totals ..	38.75	269.8	32.85	187.85	16.9	240.1

P. B. COW AND CO., LTD.—The directors recommend for the approval of the stockholders at the annual general meeting to be held April 29, 1952, that a dividend on ordinary stock of 15 per cent. (less tax) be declared for the year ended December 31, 1951.

BAKELITE, LTD.—The telephone number of the London office of Bakelite, Ltd., at Grosvenor Gardens, S.W.1, has been changed to SLOane 0898 (17 lines).

LACRINOID PRODUCTS, LTD.—Mr. A. Lawrence has been appointed sales manager in charge of Home Sales of all the company's products with the exception of buttons; Mr. W. H. Bromley has been appointed export sales manager; and Mr. H. H. Goulding has been appointed production controller, in charge of buying.

WALLINGTON WESTON AND CO., LTD.—The Foremen's Club of this company held their annual dinner and dance at the George Hotel, Frome, on March 10, when Mr. J. B. Frew, chairman of the board of directors, Mr. C. J. F. Mitchell, managing director, and Mrs. Mitchell, were the principal guests.

R. H. WINDSOR, LTD., Leatherhead Road, South Chessington, Surrey, inform us that they have closed down half of their London Office, with the removal to Chessington of the Accounts, Shipping and Patents departments. This leaves at Royal London House, 16, Finsbury Square, E.C.2, only the Sales Departments, which have been split into the following Divisions: Mr. J. Dow, manager, Extrusion Sales Division (Home and Export); Mr. S. Vadja, export sales manager, and Mr. E. A. Norris, home sales manager, Injection Moulding Machines, Moulds, etc. (i.e., all equipments other than for extrusion). All cables and telegrams should now be directed to: "Winplas, Surbiton, Surrey," and the Registered Office is now at Chessington.

FOSTER, YATES AND THOM, LTD., of Blackburn, regret to announce the death of their technical director, Mr. Herbert Dowell, on March 4 after a long illness.

A. BOAKE, ROBERTS AND CO., LTD., manufacturers of solvents and plasticizers, Stratford, E.15, recently presented gold watches to 75 employees who have served the company for 25 years and over. One of the recipients, Mr. E. A. Banyard (outside representative), had 49 years' service to his credit. The presentation was made by the Chairman, Mr. E. J. Boake, and members of the board present included Mr. F. M. Roberts (vice-chairman), Mr. F. W. Lewis (director), Mr. F. G. Pentecost (managing director), Mr. H. G. Buck (company secretary), and Mr. F. Wilkinson (director).

B.L.C. (EXPORTS), LTD, 35-39, Maddox Street, London, W.1, have been established to trade in moulding powders, principally for export. They sell in the export field the powders manufactured by The Ly-Bak Co., of Shoreham.

MR. E. K. COLE opened the All-India Conference of National-Ekco Radio Dealers in Bombay, March 17-20. While in India, Mr. Cole conferred with Indian principals of National-Ekco Radio and Engineering Co., Ltd., on future developments.

BRITISH FILTERS, LTD., Cox Green, Maidenhead, announce that Mr. R. Fish has joined the company in the capacity of works manager.

A recent portrait of Sir James Swinburne, Bart., F.R.S., by T. C. Dugdale, R.A., was commissioned by the directors of Bakelite Ltd. and was unveiled by Lady Swinburne after a luncheon to celebrate Sir James's 94th birthday. Sir James was one of the earliest workers in this country on phenol-formaldehyde resins. He founded the Fireproof Celluloid Syndicate in 1904 and the Damard Lacquer Co. in 1910 to manufacture and sell lacquers based on these resins. The Damard Lacquer Co. together with Mouldensite Ltd. and Redmanol Ltd. became Bakelite Ltd. of which Sir James was chairman until he resigned in 1948.

The late Major S. M. Mohr.

OBITUARY.—Major Stanley Melbourne Mohr, O.B.E., M.C., M.I.E.E., managing director of The Micanite and Insulators Co., Ltd., died on March 10. He was born in London July 7, 1885, received his technical education at Finsbury Technical College, London, and in 1903 proceeded to the British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester, serving three years as a college apprentice. In 1906 he was sent to Russia where he occupied the position first of senior erection engineer and later general manager in Russia for the British Westinghouse Electric and Manufacturing Co., Ltd. He came home from Russia in 1914 to join the Army and served with the Sherwood Foresters 1914 to 1920 in France, Belgium and Russia, and was awarded the O.B.E. (Military) and Military Cross, was twice mentioned in despatches, and retired with rank of major.

On January 1, 1920, he joined The Micanite and Insulators Co., Ltd., first as sales manager, later becoming sales director, and was appointed managing director in 1930. He was also managing director of British Tego Gluefilm, Ltd., and chairman of Oiled Silk Industries, Ltd.; in addition, a director of Associated Insulation Products, Ltd., and of J. Burns, Ltd.

Major Mohr was a member of the B.E.A.M.A. Council from 1944 onwards; he was chairman of the British Plastics Federation from 1939 to 1944, and president of the Plastics Institute for the session 1945-1946.

A man of vigorous and dynamic personality, he joined M. and I. when the company was still young and brought into it the trained mind of an engineer and experience gained at home and abroad.

Export Enquiries

The following enquiries are taken from the Special Register kept by the Commercial Relations and Exports Department, Board of Trade, Thames House North, Millbank, London, S.W.1:—

Greece.—Aleco Bruzis and Co., Kolokotroni Street, No. 21A, Athens, wish to obtain agencies for thermoplastic and plastic raw materials. Bruzis and Co. act as manufacturer's agents at Athens for a number of United Kingdom and other concerns. (Ref. CRE/8104/52.)

Machines for the Industry

The Turner 50-ton Moulding Press

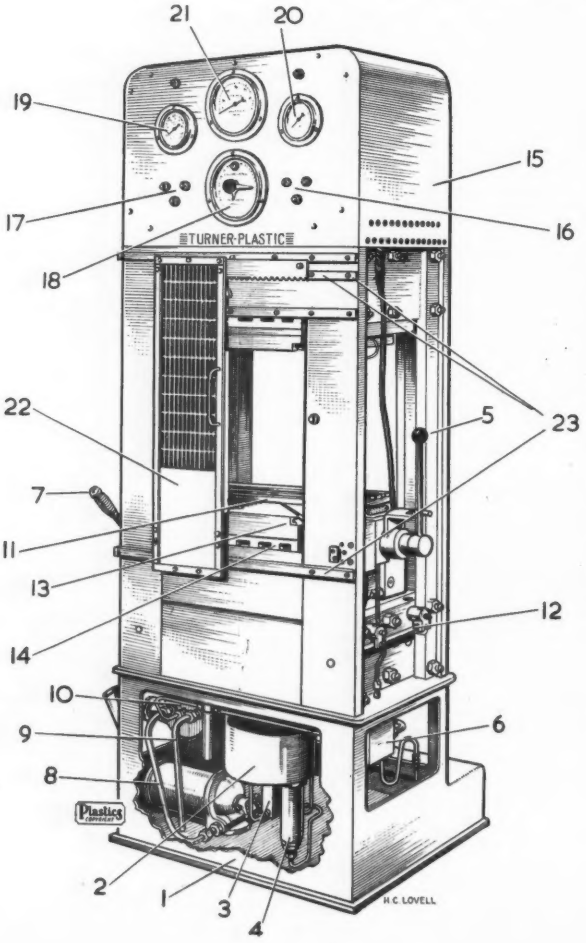
This article describes the 50-ton completely self-contained moulding press made by Turner Manufacturing Co., Ltd., Villiers Street, Wolverhampton.

THE Turner 50-ton compression moulding press is a completely self-contained upstroke machine having an adjustable pressure range from 12 tons to 50 tons.

The press is strongly constructed and has a main frame of fabricated steel plate, the inner faces of which are machined at an angle of 45 degrees to provide a bearing for the adjustable guide blocks which are attached to the lower or moving platen, thereby providing accurate tool alignment. These guide blocks are made of porous bronze, and are impregnated with oil to provide lubrication over a long period.

The base of the machine (1) forms the oil reservoir with a capacity of 12 gallons; a sight glass is provided to assist in maintaining the correct oil level. The complete hydraulic system is housed within this tank, which has felt-lined inspection covers to exclude foreign matter. The left-hand side cover has an oil filler pipe with a fine-gauge filter mounted in a convenient position, also a quickly detachable rubber cover to provide access to the pump handwheel for setting the pressure control.

The cylinder assembly (2) is of the double-ram type, and the main ram has an annulus which provides the return force for opening the press, separate drawback rams being eliminated. With this arrangement a closing speed of 2 ins. per second is obtained when the oil is fed to the inner ram. As the moulds close, the transfer valve (3) automatically comes into operation, and the oil is then fed into the main cylinder which has pre-



1.—Oil tank.
2.—Cylinder.
3.—Transfer valve.
4.—Exhaust valve.
5.—Control lever.
6.—Selector valve.
7.—Ejector reset lever.
8.—Oil filter.
9.—Circulation pipe.
10.—Hydraulic pump.
11.—Lower ejection bars.
12.—Ejection reset mechanism.
13.—Lower hotplate showing T-slot.
14.—Hotplate insulation.
15.—Instrument and control cabinet.
16.—Heater push buttons.
17.—Pump motor push buttons.
18.—Interval timer.
19.—Lower platen thermometer.
20.—Upper platen thermometer.
21.—Pressure gauge.
22.—Sliding guard.
23.—Guard rails.

Fig. 1.—Turner 50-ton plastics moulding press.

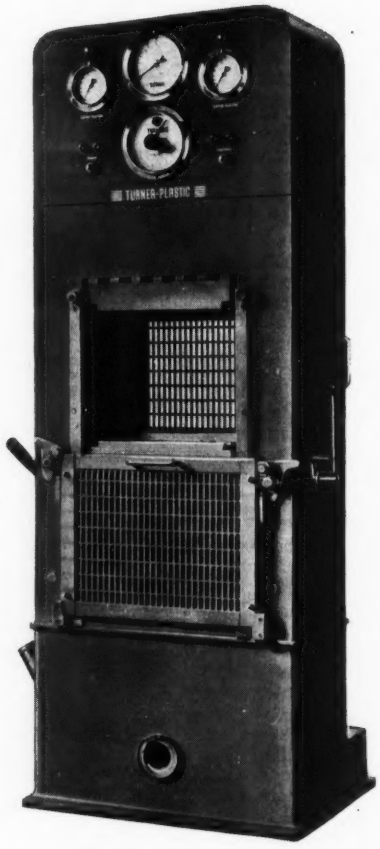


Fig. 2.—Turner 50-ton plastics moulding press.

filled through the combined intake valve and cylinder exhaust valve (4) during the approach stroke; the full closing pressure is then applied to the whole ram area. The mould opening force is 5 tons when the machine is set to maximum pressure and 1 ton when set to minimum pressure. The opening speed is 1½ ins. per second. Daylight between hot plates is 14¼ ins. and the stroke of the ram is 12 ins.

The rams are hard-chrome plated to ensure long seal life, and the main ram is protected by a gaiter.

A single operating lever (5) controls all ram movements, and is interlocked with the guards to ensure complete safety in operation. This lever operates the piston in the selector valve (6), which directs the oil from the pump (10) to the centre ram for the up stroke, or to the

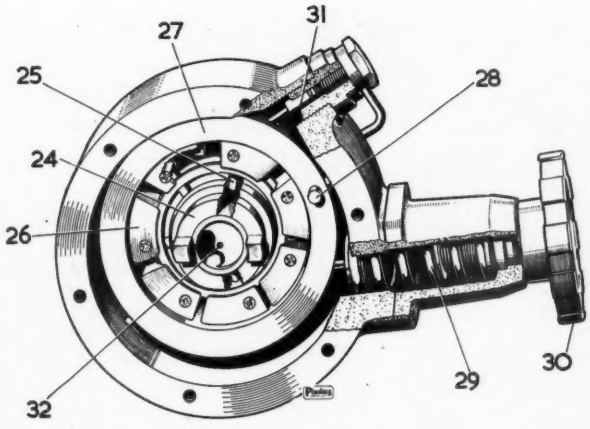


Fig. 3. — Turner A.V.D. 29. Hydraulic pump, as used in Turner 50-ton moulding press.

24.—Rotor.
25.—Pistons.
26.—Slippers.
27.—Track ring.
28.—Pivot pin.
29.—Spring.
30.—Handwheel.
31.—Control piston.
32.—Ported valve.

annular space for the down stroke. In the latter case, oil is also fed to a small hydraulic piston in the exhaust valve (4), which opens the valve so that the oil which was drawn into the cylinder during the up stroke can be returned to the reservoir by the descending ram.

The electrically heated hot plates (13) are 15 ins. by 15 ins., and diagonal T-slots are provided for securing the moulds. Each hot plate has six heating elements, which are connected for three-phase supply, the loading being 2.4 kW per hot plate. Heat control is by a thermostat in each hot plate covering a range from 200 degrees F. to 400 degrees F., and the temperature is indicated by 4-in. dial-type thermometers (19) and (20) on the instrument panel.

Upper and lower mechanical ejectors are fitted, the upper ones being reset by the upward movement of the ram. The lower ejectors are reset by a lever (7) conveniently positioned on the left of the press, and this operates entirely independently of ram movement. Hydraulic ejection can also be offered.

Hydraulic power is supplied by the Turner A.V.D.29 rotary pump; a detailed sketch is shown in Fig. 3. The rotor (24) carries seven radially disposed pistons (25), to which are attached the steel slippers (26) having a white-metal bearing face. The track ring (27) swings on the pivot pin (28) and is held in an eccentric position by the spring (29), the tension of which is adjusted by means of the handwheel (30) to determine the operating pressure of the machine.

In operation the pump continues to deliver its full volume of oil until the pressure in the circuit forces the small piston (31) downwards in its cylinder, thereby moving the track ring over against the tension of the spring until in the concentric position the pump ceases to deliver oil, but continues to maintain the set operating pressure. It will be seen that, by adjusting the tension of the spring, the point at which this cut-out occurs can be controlled to provide the required pressure on the ram, and that once the setting has been determined the pump will automatically cut out at the correct pressure each time the press is closed.

While the pump is running in the no-stroke or cut-out position during the curing period, it is necessary to provide a flow of oil through the pump body for cooling purposes, and this is achieved by means of the circulation pipe (9), which carries the warm oil back into the reservoir.

When the pump is idling in this way the power consumption is only 0.65 h.p., even though the pump is maintaining the maximum load of 50 tons, and consequently it is possible to use an electric motor much smaller than would otherwise be necessary. A totally enclosed surface-cooled 1.75 h.p. motor is used, running at 1,440 r.p.m., and this is mounted on the rear wall of the tank, the drive to the pump being direct through a flexible coupling.

A downward-opening front guard is fitted as standard, but a side-opening type can be supplied as an alternative.

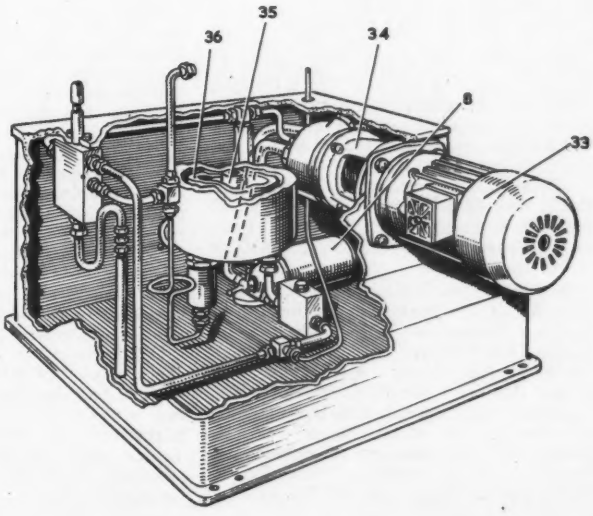
In addition to the upper and lower platen thermometers, the instrument panel also has a 6-in. pressure gauge calibrated in pounds per square inch and total ram force in tons; push-button controls for the pump motor and heating elements, and an interval timer.

The timer is operated by a small synchronous motor and has a warning light which indicates the curing period up to a maximum of 15 minutes, the dial being marked in 15-second divisions. An adjustable pointer stop is provided to enable the operator to repeat the curing period accurately. The pointer is normally in the zero position, and as the press closes it is only necessary for the operator to turn the pointer to its stop. This starts the synchronous motor and illuminates the warning light. The pointer then moves back to the zero position and the light is extinguished, thus indicating the end of the set period. Indicator lights are also provided in the push-button circuits and in the heater circuits.

The door at the back of the instrument and control cabinet carries the electric control panel, on which are mounted the motor and heater contactors, fuses, overload trips and the transformer.

An electric time switch can be built into the machine which will switch on the heaters so that the moulds are at the correct temperature in readiness for the commencement of work, and thereby avoid the period of waiting for moulds to heat up.

The press occupies only a minimum of floor space, the base measurements being 2 ft. 5 ins. wide by 2 ft. 1¼ ins. deep; overall depth, including the electric motor, is 2 ft. 5¼ ins. and the height is 6 ft. 6 ins.



8.—Oil filter.
33.—Electric pump.
34.—Pump mounting adaptor.
35.—Centre ram.
36.—Main ram.

Fig. 4.—Rear view of tank assembly, for Turner 50-ton moulding press, showing the hydraulic system.

Design Competition for Automobile Facia Panel

THREE prizes of £50, £30 and £20 are being offered by the sponsors, British Industrial Plastics, Ltd., for the best designs for an automobile facia panel submitted for the 9th Design Competition organized by "Art and Industry."

The panel of judges comprises: Vernon Hardy, M.A., M.I.Mech.E., A.M.I.E.E., engineer and competition motorist; E. G. M. Wilkes, M.S.I.A., late chief styling engineer to the Rootes Group; and A. H. Woodfull, M.S.I.A., head designer of the B.I.P. Product Design Unit.

In selecting a motorcar as the subject for this competition, the sponsors were confronted with the following alternatives:—

(i) To ask competitors to design a facia panel embodying standard instruments and to tie them down rigidly to the same restrictions as are imposed upon the motor industry's designers.

(ii) To waive "standard practice" and impose a minimum of rigid specification, so that competitors have the greatest freedom possible.

As the competition is being treated experimentally, the second course has been chosen in the belief that the results may suggest more interesting treatments than obtain in the facia panels of the mass-produced motorcar of to-day. At the same time, the competitor must bear in mind that the problem is mainly one of "instrumentation"; it must, therefore, be approached in an essentially practical manner and such considerations as ease of fitting, adjustment and/or replacement will require to receive careful assessment.

Competitors have complete freedom in styling their own instrument dials and switch knobs, but must remember to allow sufficient space to accommodate the mechanisms behind the facia.

The following specification must be complied with:—(i) The facia panel must be suitable for moulding wholly or mainly from "Beetle" urea or melamine plastics material. (ii) It must be suitable for a typical medium-priced saloon car of about 2 litres. (iii) It must be adaptable for right-hand and left-hand controls. (iv) Provision must be made for (a) de-misting of windscreen, (b) radio installation as an extra, (c) heater controls and (d) instrument lighting. (v) The minimum number of instruments must include (a) speedometer, (b) clock, (c) water temperature indicator, petrol and oil gauges, and (d) ignition and lighting switches, including ignition warning light.

Competitors are asked to submit a complete facia layout in the form of a coloured perspective drawing, accompanied by plan and elevation drawings to scale.

"Beetle" material is available in a wide range of grades and colours. All competitors will, on application to British Industrial Plastics, Ltd., Publicity Department, 245, Oxford Street, London, W.1, be provided with descriptive booklets containing the fullest technical information and, if they wish, discs indicating the colour range.

The main features upon which entries will be judged are that the design shall be (i) practical in use (i.e., visibility, accessibility of instruments and fittings which must be arranged in a manner comfortable to use), (ii) practical in production, and (iii) pleasing in appearance. Other features to be considered by the judges will be the originality of the design, the standard of draughtsmanship and the quality of presentation.

All entries must be submitted not later than May 31, 1952. Further particulars, together with rules governing the competition, may be obtained on application to The Editor, "Art and Industry," 66, Chandos Place, London, W.C.2.

CONFERENCE ON ADHESION

The Society of Chemical Industry are holding a conference on "Adhesion" at London University, April 22 to 24 inclusive. The papers to be presented are as follows:—

Session I, April 22 (morning). Chairman: Sir Eric Rideal, F.R.S. "Some Possible Surface Factors Involved in Joint Strength" (D. D. Eley). "The Relation Between Friction and Adhesion" (D. Tabor). "The Adhesion of Metals" (G. W. Rowe). "The Wetting of Solids by the Process of Direct Contact" (J. F. T. Blott, R. I. Hughes, and L. A. Werrett).

Session II, April 22 (afternoon). Chairman: Dr. D. D. Eley, M.Sc., Ph.D. "The Part Played by Fluids in Adhesion" (the late W. G. Campbell). "Intermolecular Forces and the Strength of Adhesive Joints" (C. Kemball). "The Mechanism of Adhesion" (J. J. Bikerman).

Session III, April 23 (morning). Chairman: J. C. Warr. "The Practice of Adhesion" (Saxon Jones). "Adhesives in the Wood-working Industry" (E. A. Davies). "Adhesion in Laminated Glass" (A. C. Waine. "Adhesion in the Construction and Maintenance of Roads" (A. R. Lee and J. H. Nicholas). "Wetting and Adhesion in Relation to the Surface Dressing of Roads with Bituminous Binders" (J. F. T. Blott, D. R. Lamb and O. Pordes). "Pressure Sensitive Adhesion" (Miss M. Gainsley and J. Dow).

Session IV, April 23 (afternoon). Chairman: Dr. J. C. Swallow. "A Review of Synthetic Adhesives with a Section on Recent Developments" (P. L. Bramwyche). "Joining Aluminium: A Summary of Present Practice" (Dr. E. G. West). "The Adhesion of Organic Coatings in the Manufacture of Metal Boxes" (J. H. Brittain). "The Adhesion of Rubber and Textiles" (W. C. Wake). "Adhesion in Sizing Textile Fibres" (K. W. Mieskis).

Session V, April 24 (morning). Chairman: Sir Roger Duncalfe. "Physico-chemical Properties of Animal Glue" (R. Barry Drew). "Sodium Silicate as an Adhesive" (W. S. Macfarlane and J. F. Sewell). "Industrial Adhesives of Vegetable and Synthetic Origin" (W. J. Opie). "Adhesive Compositions Prepared from Resin and Rubber Emulsions and Admixture with Hydraulic Cements" (L. H. Griffiths)

A Conference Dinner will be held in the Connaught Rooms, Great Queen Street, W.C.1, on April 23. Details of the conference and tickets for the dinner may be obtained from the Assistant Secretary, Society of Chemical Industry, 56, Victoria Street, London, S.W.1.

PLASTICS IN THE BUILDING INDUSTRY were reviewed by Mr. L. H. Griffiths, M.Sc., F.R.I.C., A.I.R.I., technical manager, Semtex, Ltd., in a paper read to the Southern Section of the Plastics Institute and the Institution of the Rubber Industry at Southampton on March 12.

In the flooring field in particular, said Mr. Griffiths, a great contribution was being made by plastics both to domestic and to commercial building. Thermoplastic tiles were now being used on a large scale as a most suitable surfacing for the concrete floors. Resins in emulsion form which could be mixed with cement to provide self-colour, hygienic and easily cleaned floors to blocks of flats, light industrial buildings and similar concrete structures, also filled a need which could not be met in any other way than by the use of plastics.

Developments in the polyvinyl chloride range of plastics promised newer and more flexible. and therefore more durable coverings which would find a ready market. It might well be predicted that a notable volume usage of the raw materials would eventually lie in the manufacture of floor coverings.

THE MECHANICAL PROPERTIES OF PLASTICS

(*Continued from page* 104)

between the absorption of sulphuric acid and the change in hardness of mouldings. In the case of materials with different degrees of resistance to chemicals, this is not easy to express quantitatively by other tests but can be readily determined by the change in surface hardness with time.

Hot Needle Indentation Tests

A needle maintained at 200 to 250 degrees C. and suitably loaded will penetrate phenolic mouldings to extents which depend on a number of variables. Results with a machine made by Bisterfeld and Stolting were described. After standardization for such variables as moulding to moulding changes and thickness of test specimens, it has been shown that the degree of cure, as measured by acetone extraction, could be followed by indentation measurement. The resistance to chemicals other than acetone could also be assessed. Different fillers and types of resin were found to give different degrees of indentation.

Such a hot needle test has a number of possible uses although it is doubtful whether it is suitable for routine testing of degree of cure. Thus the incidence of discoloration in mouldings was shown to be associated with differences in the amount of indentation, which supported the theory that the discoloration had been caused by local differences of heating. In another case the extent of post stoving of silicone mouldings could be followed by measuring the penetration obtained with the hot needle.

"Plastics" Index.—The index to "Plastics," Vol. XVI, January to December, 1951, has now been published. Copies are available, price 1s. 2d. post free, from Temple Press Ltd., Bowling Green Lane, London, E.C.1.

Successful Designing for Plastics Moulding—XXXI

By W. M. HALLIDAY

This is the last instalment of the present series. The author deals with the location of lettering, and finally summarizes the chief design factors which have been considered throughout the series.

THE position of lettering has to be carefully determined on the surface of the moulded article, so that the ejection of the piece will best be ensured. This will be particularly necessary where such impressions are situated on an external surface.

Where the lettering is situated on an interior surface it will generally be reproduced from impressions formed into the end or side of a core, preferably the former since this allows the simplest form of ejection. Normally, the finished component will be pushed off the core, where this is stationary in the mould; alternatively, the core may be movable to draw out of the moulding before ejecting it from the cavity proper. On the other hand, the core may be of the split type, capable of being collapsed at a certain stage.

As a general rule, lettering should be situated on a surface in the mould lying parallel with the main parting-line joint of the mould blocks, or parallel to a carefully selected secondary joint, where the mould is of the built-up or split type of construction

It may be situated on a surface at right angles, or steeply inclined to the main parting joint, but usually such locations will necessitate a separate pad or slide, in order to avoid intervention when the moulding is ejected along a line at right angles to the normal mould parting joint.

Sometimes lettering may be situated upon a surface inclined relative to the main parting joint, providing that surface upon ejection can be withdrawn without interference with other portions of the cavity or cores, and in such a way that the formed letters raised on the side of the moulding will leave the recessed impressions in the mould cavity in a smooth and free manner.

Size and Form of Lettering

To obtain the best results, from finished appearance and simplified mould construction, some attention must be given to the size and forms of letters. This will apply to all slightly relieved features, either decorative or partially functional, such as panels and symbols.

Fig. 1 illustrates suitable proportions and preferred forms for raised letters on the surface of a moulded article for general purposes. The height of relief X need only be relatively small, i.e., from .008 to .015 in., this amount usually being found quite adequate to give excellent reflection of high-lights so as to make the letters plainly visible. A relief height of about .010 in. will generally be very satisfactory for small-size lettering where the length of letter does not exceed about $\frac{1}{4}$ in. For larger-size impressions, the relief height X may be increased to range between .025 to .045 in.

With all letters, numbers or figured impressions embracing several straight sides and involving sharp corners, as shown in Fig. 1, it will be advisable to employ small radii at those points, after the fashion depicted at Y. Several useful practical advantages will be derived from adoption of this practice. It will increase the durability and wear-resistance of the mould impressions and greatly arrest the effects of slight erosion occurring on those portions of the mould impression; it will also produce a more pleasing effect in the finished component.

The chief advantage gained, however, will lie in the greatly simplified reproduction offered to the mould machinist, when intaglio impressions have to be made by means of a rotating cylindrical cutter. The production of perfectly sharp corners in a hollowed recess will be almost impossible when using a revolving round cutter, and when sharp corners are specified, the small radii left by such a cutter would have to be dressed off by hand-tooling methods. These would be tedious and costly. The alternative would be to have recourse to a built-up or sectional type of construction for the mould cavity.

However, by specifying small radii on all corners of the lettering, as at Fig. 1, all these limitations will be avoided. The radii need only be small, i.e., about 1/32 in., thus enabling a small finishing milling cutter of about $\frac{1}{16}$ in. diameter to be employed. One pass of this cutter around the edges of the depressed letter impression would then suffice to clean up sides accurately and reproduce the correct radii in all corners.

It will also be advisable to employ a slight degree of taper on the sides of all letters, this usefully ranging between 3 to 5 degrees, as shown. This taper may easily be reproduced by forming the cutter in like manner, and will give additional ease during the ejection of the finished component. Where a considerable amount of lettered or figured work has to be adopted, the use of side taper of this kind will be found especially valuable by minimizing the tendency of the component to "hang" in the cavity, and might therefore lead to reduced risks of distorting or warping the delicate wall portions.

The edges at the crest of the letter may be left perfectly sharp, as shown at Z, a feature which again will be automatically formed by the cutter. It will often be advisable, however, to allow a generous radius fillet at the root of the letters where they join to the surface of the moulding. This will give additional strength, and also serve to remove a perfectly keen razor edge at the mouth of the hollow impressions in the mould. Radiused edges at this point of the cavity would be less liable to suffer damage or wear.

Photographic-etching for the Lettering of Moulds

In cases where an extensive amount of lettering and similar inscriptive work has to be used with a moulded component, such as would be required with instructions describing how an article has to be used, the requisite lettered impressions may be formed in the mould cavity by an economical photographic-etching process, which does not involve substantial metal removal.

The mould cavity would be completed

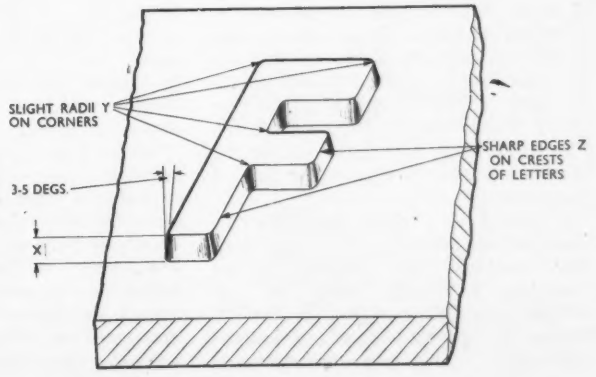


Fig. 1.—Proportions and form preferred for raised lettering on the surface of a moulding.

in every way and hardened and polished to the necessary lustre. The surfaces on which lettering is to be reproduced are then treated with a light-sensitive substance, and a master replica, in negative form (produced from an ordinary printed drawing of the letters, etc., made up by the designer on the drawing-board) is employed to print the impression upon the metal surfaces by a photographic means. Finally, these impressions are etched into the metal by treatment with acid.

The amount of relief to letters formed in this simple manner will be exceedingly small in comparison with that obtainable by actual cutting or hobbing methods, but nevertheless sufficient in depth to ensure impressions which will be plainly visible. One advantage derived from this method is that most intricate forms embracing all kinds of purely ornamental figured embellishments may be reproduced very quickly and simply. Printing by photographic means drawn from a master template ensures the most accurate and faithful transmission of minute figured details, which often would prove impracticable or very costly.

Briefly summarizing the present series of articles and to present in a convenient manner most of the chief design factors considered throughout this series, the following list of preferred features will be helpful in guiding the component designer:—

Compression Moulding

(1) Employ minimum wall thickness commensurate with adequate mechanical strength and stiffness in the component. Maintain such wall thickness as nearly uniform as possible throughout all portions of the part. For parts of small or average size a wall thickness ranging from 3/32 to $\frac{1}{8}$ in. will be satisfactory; for large-size components this may be increased up to about $\frac{1}{4}$ to $\frac{5}{16}$ in.

(2) Specify ample radius fillets at all corners where sides join, or at root of ribs, flutes, beads and bosses. Similar fillets should be employed at all junctions where sectional thickness changes. Use fillets of maximum radius wherever possible with 3/64 in. as the minimum value, except in the case of very small conical bosses where a radius at the root of about 1/64 in. will be satisfactory. Bear in mind that large radii greatly simplify machining of the mould, and may eliminate much costly hand polishing work. Fillets of this kind will also retard mould wear and erosion on critical portions, as well as reducing the liability towards cracking on the finished component.

(3) Avoid use of large plain, flat surfaces, as these generally more easily show flow markings and similar surface blemishes. Relieve or "break" all such uninteresting flat surfaces by flutings, beads, ribs, panels, figured or lettered impressions. This will subdue minor surface imperfections and also serve to stiffen relatively unsupported walls.

(4) Holes situated at right angles to the normal main parting line joint of the mould will prove most suitable, as the axis of core will then be in alignment with direction of mould opening. Holes located obliquely or parallel to the main parting joint, and having to be formed in the sides of the component, will cause additional complication in mould construction by necessitating splits, insert pads or collapsible type cores. Use of these features generally will entail additional flash-lines, greater attention when de-flashing the moulding, and may also be the source of error by impairing location of hole centres. Mould costs will also be increased and a slower speed of operation during production might be expected.

As far as possible, allow ample taper on sides of all holes to facilitate extraction of cores. Maximum diameter of hole should lie at the main parting-joint of mould. In regard to permissible depth of hole, this will depend upon its location, whether blind or full-through, wall thickness and diameter of hole.

Blind holes, generally, involve less expense and trouble with mould construction and operation than will full-through holes. These latter will have to be piloted accurately in both top and bottom forces, thus error may easily arise in course of production due to wear on one or both guide holes or the relevant portions of the core.

Very small diameter and long holes should not be moulded by coring, as the costs involved with correcting core plug displacement and damage will be excessive.

Threaded holes may be moulded providing pitch of thread is coarse, and the form is such as to permit slight rounding at crests and roots. Fine-pitch threads may be difficult to form, especially on small root diameters owing to the inability of the slender core pin to resist flowing pressures and frictional drag.

Stepped holes may be moulded if these are blind, so permitting all the hole shape to be reproduced from a single solid core plug mounted in top or bottom force. Where full-through stepped holes are desired, care will be needed in selecting the main parting-line position in the mould so that the largest diameter portion of hole may be formed in one block, so as to avoid undercutting, and give best ejection.

(5) As far as practicable, design the component shape so that this may be reproduced from a cavity in a single-piece block. This means avoidance of undercuts, recesses in external sides, and a gradually decreasing internal opening. Select the simplest geometrical forms with a view to the easiest reproduction in reserve form in the mould cavity. This will not only reduce mould costs, but will allow the tool to be worked at a faster speed, and may also greatly reduce flash-lines and possible sources of error on the component. All these latter features tend to occur in marked degree where a sectional or built-up mould construction is required in order to produce "difficult" component shapes.

(6) Use ribs, beadings, webs, bosses and similar strengthening features freely. Their introduction will assist in obtaining uniform wall thickness, of minimum scale, without weakening the part. This will afford useful material savings, simplify mould cavity formation, produce better flow, and generally improve appearance of the finished article.

Where ribs, etc., are used purely for decorative purposes, keep the height relief very small, and employ small radii at crest and root to obviate cracking. For larger ribs and bosses, draft or taper should be employed on side portions, with a minimum of 1½ degrees. The larger the angle of taper on these portions, the greater will ejection be facilitated.

(7) Always allow the greatest dimensional tolerance, on holes, overall dimensions and other critical features. Very fine tolerances, of the order of plus or minus .001 in. per inch of dimension, can be attained; this will involve extremely accurate construction of the mould, with commensurate increase in costs. Tolerances on the wall thickness of a component should be as liberal as possible to allow for flashing at the main parting joint, and the normal contraction variations with moulding material. This varies according to the grade of moulding powder and certain working conditions, but may be regarded as approximately .006 to .008 in. per linear inch of dimension. This may not be uniform throughout all portions of the moulding, since shape of wall section and thickness will have an important effect.

(8) Do not locate holes or major portions of the cavity formations too close to the edges of the moulded article, as this would tend to mechanical unsoundness and risks of cracking. An adequate amount of wall material must be left between all holes or openings to minimize danger of cracking and/or distortion due to contraction and ejection.

(9) Raised letters on the side of a moulding will be preferable to sunken letters. The former can be most easily reproduced in the mould, especially if located on some top or bottom surface on the component rather than on a side. Location of this kind will obviate the need for loose detachable or sliding pads, slides, or splits in the mould.

(10) Closure covers, caps knobs and similar components requiring additional finger-gripping facilities on their exterior, should be provided with straight-line serrations or knurling, rather than diamond type. The knurled serrations must be located axially in line with the

opening and ejection of the mould. Straight knurling is easily reproduced in the mould by hobbing, and also ensures simplest ejection from the mould.

(11) Endeavour to envisage where the mould parting-line joint will occur on the component. As far as possible this should not be situated upon either a perfectly straight or flat surface, owing to the difficulties experienced in de-flashing, and the unsightly effects produced on such a surface when flash is removed. Consider in what manner, to what extent, flashings can be eliminated or minimized by the introduction of ribs, beadings and similar features. These often can be employed to camouflage or subdue the small scar left when a flash is removed.

(12) Give closest attention to the manner in which the component may be ejected from the mould, bearing in mind that this operation is usually performed manually with compression moulds, and thus the need is acutely present for simple, rapid and inexpensive ejection features. Special consideration will be required in reference to the disposition of knock-out rods, and the possible flashing effects produced by such members where they impinge onto the walls of the component.

(13) Check carefully the component design to ensure that the shape and contoured surfaces are of the simplest kind capable of being produced wholly in a two-piece mould. Eliminate complex shapes if no sound functional or mechanical reason can be found for their use.

Injection Moulding

Nearly all the features already mentioned will apply in the case of injection mouldings, but the following additional points should be noted:—

(14) Very carefully consider requirements respecting disposition of parting-line, so that cavity reproduction in the mould will be of the simplest and most accessible character, and also that runner and gate feeds may be situated in the most suitable places.

(15) Aim at constant thickness of wall section throughout the moulding. For preference select a relatively thin wall section reinforced with ribs, beadings, or small bosses, rather than an unreinforced thick wall section. Greater strength and rigidity will usually be obtained by the former at the expense of less material, and with less tendency towards surface defects.

With very small size articles wall thickness as small as .020 in. may be reproduced, and it will rarely be necessary to exceed about .250 in. wall thickness even with a very large component. Generally, thin wall sections will require a somewhat higher injecting pressure than thick walls, owing to the restriction to flow presented by the requisite narrow channels in the mould cavity.

(16) Where necessary perfectly sharp corners can be injection moulded without great difficulty, but it will usually be advisable to specify small radii at all external and internal wall-joints, as this will facilitate construction of the mould cavity, and cores, and at the same time promote longer working life with these members.

(17) Allow the maximum degree of taper on the sides of the component, and all holes to be moulded therein. This will be important, because ejection of the finished component from injection moulds has to be accomplished with great rapidity.

(18) Greater facilities will be available in respect of cored holes, since the interaction between flowing material and projections into the mould cavity will not be as severe as in the case of compression moulding. This will mean that longer and/or smaller diameter holes may be cored with safety.

(19) Critical dimensions on the component can be maintained within close limits, especially where these are wholly reproduced by the cavity portion in one block. Wider tolerances should be permitted in respect of all dimensions which are intersected by the main parting joint of the mould. Whilst the two mould blocks will be held powerfully in the closed position during injection, owing to certain heat and/or pressure variations, or the intervention of dirt on the parting-line joint, etc., certain slight variations may occur, resulting in similar errors on some dimensions of the component. Wide tolerances will also assist the moulder in overcoming the effects of normal contraction on a moulding when cooling occurs. The rate of contraction is somewhat variable according to material used, thus making exceedingly fine tolerances difficult to achieve.

(20) Metallic and other inserts can be readily employed with this process of moulding, because there will be little tendency for them to become misplaced in the cavity area during actual injection of the material. Retaining pins required for mounting inserts in the form of sleeves and bushing may be correspondingly smaller in diameter than those necessary for compression moulding.

(21) Determine where the component will be fed, so that gate scar will occur on some unimportant edge or surface.

(22) Careful consideration must be given to the manner in which the component may be ejected. Where the push-pin method is to be adopted, ensure that the push-pins will bear upon some internal surface, or some surface where finish will not be of prime importance. If the pins have to impinge upon a critical surface where finished appearance is important, employ small bosses or ribs or similar features, upon which the resultant push-pin flash will lie. This affords better opportunities for complete removal of flash at those points.

(23) Try to envisage how the component shape will be reproduced in a split type metallic mould, with special reference to machining of cavity formations, application of cores and ejectors, and how the runner-gate system of feeding will have to be arranged. These factors are of paramount importance to the mould designer, and simple modifications to the shape of a moulded component will greatly assist in simplifying one or all of these problems.

Correction

The author's attention has been drawn to an error in the formulæ, and an inconsistency in the text of the article, appearing in this series, "Plastics," February, 1952 (page 57).

The area of the sleeve insert exposed to flow pressures should be D x L, and not 3.14 x D x L as there given.

The empirical rule of the ratio between this area and that of the cross-section of the support pin, or the hole in the sleeve, should therefore read:—

$$D \times L : \frac{d^2 \times 3.14}{4}$$

It has also been pointed out that this rule is identical with one originated by Mr. M. Freund, M.I.M.E., whose permission to publish should have been obtained. Full apologies for this unfortunate oversight are due to him, and the author of the article wishes to make the proper acknowledgements.

Readers interested in studying this aspect of insert design and use more thoroughly are recommended to read Mr. Freund's book, "Plastics Moulding Engineering."

FORTHCOMING MEETINGS

Apr. 16.—Annual General Meeting and Smoker, Plastics Institute, Scottish Section. Institute of Engineers and Shipbuilders in Scotland, 7.30 p.m.

Apr. 18.—"Compounding and Calendering," P. I. Wilson, Plastics Institute, Midlands Section. James Watt Memorial Institute, Great Charles Street, Birmingham, 6.30 p.m.

Apr. 23.—Meeting to be arranged, Plastics Institute, North-Eastern Section.

Apr. 23.—"Permali," N. G. McCullagh, Plastics Institute, North-Eastern Section. Lecture Hall, Miners Institute, Newcastle, 7 p.m.

Apr. 25.—"Cellulosic Plastics," B.T.A. Holland, Plastics Institute, North-Western Section. Engineers Club, Albert Square, Manchester, 6.45 p.m.

Apr. 30.—Annual General Meeting, Plastics Institute, Yorkshire Section. St. Mark's House, 186, Woodhouse Lane, Leeds, 7.

May 6.—"Chemical Engineering and Atomic Energy," C. M. Nicholls and A. S. White, Society of Chemical Industry, Chemical Engineering Group. Burlington House, London.

May 14 and 21.—Visit to "Birmingham Post and Mail" Printing Works (12 members each date), Plastics Institute, Midlands Section.

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. The country of origin for Convention Applications is shown in parentheses. Complete specifications can be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, price 2s. 8d. each (including postage).

B.P. 658,704. Moulded cosmetic boxes and like containers having hinged covers. To: Columbia Protektosite Co. Inc. (U.S.A.).

A plastic leakproof powder box has a box-like anchoring structure integral with the container and a resilient yoke-shaped hinge portion integral with the cover.

B.P. 658,743. Method of applying a thermoplastic material to foundation surfaces. A. F. Collins.

The plastic sheets are bonded to a cementious foundation on, e.g., kitchen or bathroom walls, table tops, service counters, etc., through an intermediary bituminous layer chosen according to the different coefficients of thermal expansion.

B.P. 658,793. Cutting blocks from an extruded rod of plastic material and their transfer to a forwarding device. A. G. Rose, J. A. Gilbert. To: Rose Brothers (Gainsborough), Ltd.

Lengths are cut in timed relation with the extruding operation and conveyed to the transfer station at a rate greater than the rate of extrusion so as to space the lengths along the conveyor. The transfer member is actuated by a detector responsive to the passage of the forward face of the severed length.

B.P. 658,804. Making non-fraying fabric labels. Markem Machine Co.

The fabric ribbon is impregnated with a thermoplastic binder in strips along the length of the ribbon spaced according to the desired width of the label. The label is printed across the space between the strips and the ribbon cut along the centre line of the strips.

B.P. 658,811. Screw stoppers for containers. S. T. Liem. To: H. F. Torringa.

A stopper for collapsible tubes, etc., with a lid or screw top on a pivotable yoke.

B.P. 658,832. Production of resin-treated filter materials. E. A. Stokes. To: Vokes, Ltd.

The powdered resin used is the rosin-modified tertiary butyl phenol-formaldehyde resin "Beckacite 1643."

B.P. 658,844. Composite materials. G. H. Whigham, B. E. M. Miller. To: Brit. Celanese, Ltd.

A thin cellulose acetate sheet (0.002 in.) carries a layer of asphalt solidified on its surface for application to floors, roofs, roadways as a waterproof cover.

B.P. 658,903. Nursing unit. To: Shellmar Corp. (U.S.A.).

A polyethylene (or similar) bottle is combined with a nursing nipple of rubber-like material through a set of clamping rings.

B.P. 658,904. Fuel cell supporting enclosure. To: Goodyear Aircraft Corp. (U.S.A.).

Self sealing fuel tanks are built up of layers of resin-impregnated nylon cloth reinforced by spaced stiffeners.

B.P. 658,986. Resinous compositions. E. H. Dafter Jr. To: American Cyanamid Co. (U.S.A.).

Surface coatings for articles which require moulding or pressing in the final operation are obtained as a dispersion of a stable gelled copolymer resin from a mixture of an ester of phthalic acid, ethyl acetate (solvent) and a peroxide catalyst copolymerized in a certain manner.

B.P. 658,992. Dispensing container. G. Piccoli. To: Faberge Inc. (U.S.A.).

A perfume vial has a plug of polyethylene with small passages which only open up when rubbing the inverted plugged bottle over a surface.

B.P. 658,994. Controlling the shrinkage of textile materials consisting wholly or partly of wool. E. H. Rossin. To: Monsanto Chemical Co. (U.S.A.).

The material (wool or partly wool) is impregnated with a resin formed by curing a melamine formaldehyde or a similar condensation product together with a small amount of free formaldehyde.

B.P. 659,014. Method and apparatus for forming, stuffing, and shaping casings. American Viscose Corp. (U.S.A.).

Stuffing is extruded from two adjacent nozzles, vinyl resin sheets are delivered to the nozzles, formed on the nozzles into sausage casings and twisted at intervals.

B.P. 659,052. Manufacture of footwear. J. E. Woolley, Vol Crepe, Ltd.

The synthetic resin sole is applied to the lasted upper in a mould by heat and pressure without stitching.

B.P. 659,056. Pressing artificial resin material. Semperit Gummiwerke A.G. (Germany).

To prevent the pressed body from sticking to the mould, the body of artificial resin is covered with a fibrous layer containing a mould lubricant.

B.P. 659,057. Production of substituted styrene homopolymers. J. J. Hayes. To: Mathieson Alkali Works (U.S.A.).

Thermoplastic moulding materials obtained by polymerization of alpha-methyl styrenes having two or more nuclear chlorine atoms.

B.P. 659,180. Slide fastener slider having pressure extensions. H. Wende (Switzerland).

Plastic compositions may be used as material for the slider which can be formed by extrusion, punching or plastic techniques.

B.P. 659,186. Boxes for the packaging and transportation of fragile articles, such as eggs. E. J. Bradstreet and Sons, Ltd.

A special compartmental insert is used. Top and bottom covers may be made of transparent sheets of plastics.

B.P. 659,191. Metal containers. J. M. Jackson, G. W. L. Morgan, Metal Box Co., Ltd.

The lid aperture of a paint can is closed by a window of transparent thermoplastic material fitted in a special way to ensure a hermetic joint.

B.P. 659,252. Extracting mandrels from cavitied plastic structures. D. Gonda (U.S.A.).

The apparatus is designed for the withdrawal of tapered mandrels used as wall supports during the consolidation of "Holoplast" panels built up as an integral whole of thermosetting resin-impregnated laminated fibrous sheets under heat and pressure.

B.P. 659,336. Securing articles to plastic material. W. I. Jones. To: United-Carr Fastener Corp. (U.S.A.).

Raincoats, baby pants, other such articles made of plastics material have metal (snap) fasteners attached by a cup-shaped plastics part gripping the metal part and welded to the article (coat, pants, etc.) by heat.

B.P. 659,338. Sterilized container and method of making same. W. W. Triggs. Comm. from: Shellmar Prod. Corp.

A tube of seamless extruded plastics (polythene, rubber hydrochloride, "Cellophane") autogenously bonded by heat is partitioned into a series of interconnected containers by spaced transverse seals.

B.P. 659,344. Hollow aircraft propeller blades. G. T. Lampton, J. M. DeBell. To: United Aircraft Corp. (U.S.A.).

The thin steel blade is filled and strengthened by a closed-cell foam of fine uniform texture formed of a thermosetting alkyd-diisocyanate resin of a density of 8 to 15 lb. per cubic ft.

B.P. 659,395. Manufacture of new three-phase emulsions of artificial resins. To: CIBA, Ltd. (Switzerland).

The resin is suitable for improving textiles, for pigment dyeing and printing processes.

B.P. 659,403. Closing device for collapsible tubes. A. Christiansen (Denmark).

The tube of plastic material has a conical neck with closed top and side aperture covered by a rubber sleeve lifted under pressure.

B.P. 659,445. Heat-curable elastic compositions. British Thomson-Houston Co., Ltd. (U.S.A.).

The material is essentially a methyl-polysiloxane of rubbery characteristics withstanding elevated (150 to 250 degrees C.) and low (−60 degrees C.) temperatures.

B.P. 659,492. Rules or scales. J. D. Macican.

One of two halves of transparent plastic material or both are engraved or printed in reverse on the underside. They are then coated and glued together.

B.P. 659,632. Closures for vacuum flasks, jugs, jars, bottles and the like. R. J. Catlin, Isovac, Ltd. (Excelvac Flask Co., Ltd.).

The cork is gripped between a top and a ring screwed together.

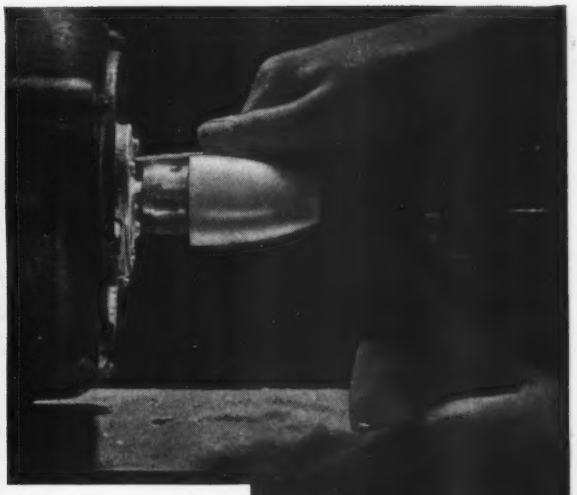
B.P. 659,671. Container-forming machine. J. C. Arnold. Comm. from: Pneumatic Scale Corp., Ltd.

Flat bags are produced from "Pliofilm."

B.P. 659,678. Polyamide resins. N. V. de Bataafsche Petroleum Maatschappij (U.S.A.).

B.P. 659,749. Method of coating thermoplastic webs with silica. R. G. Kenelly. To: Monsanto Chemical Co. (U.S.A.).

A heat sealable vinyl resin for wrapping and packaging is coated with a silicon organosol. The liquid evaporates, leaving a transparent deposit preventing sticking of the material in storage or transit.



ask your moulder. . .

This is the fifth in a series of announcements designed to assist buyers in purchasing plastics moulded articles or components.

When a moulder talks about the 'finish' of his moulding, be sure that you know precisely what to expect. The types of finish applied to thermosetting plastics fall into two main categories :—

1. **MOULD FINISH.** In a mould finish, the surface finishing is confined to the removal of flash by careful filing or machining. Drilling and tapping or similar operations are performed, if necessary, but the actual surface finishing stops short at flash removal.

2. **POLISH FINISH** In a polish finish, on the other hand, the entire exterior surface is grease-mop polished to provide a lustrous appearance; this being additional to flashing and any necessary subsequent machining.

Small articles such as buttons and small closures are usually barrelled. This means that for mould finish they are put in quantity into a barrel and revolved for a period of time to remove the flash. For polish finish they are loaded into another barrel with the correct proportion of oil-impregnated wooden pegs and are barrelled mechanically to impart lustre.

There is all the difference in the world between these two standards of finish; so be sure to specify the exact type of finish you require.

For thermoplastic mouldings, buffing is not always necessary or desirable.

The surface finish of any moulding essentially depends on the precision with which the tool is made and the care taken in moulding. The chromium-plating of moulds greatly improves the finish and should invariably be specified.

Not all jobs may require a polish finish. Where it is not needed, price savings can be effected; but where it is necessary, make sure that your moulder is fully equipped to provide it.

* *The illustration shows . . . Left, mop polishing and right, lathe filing in the finishing section of the works of The Streetly Manufacturing Co. Ltd. All thermosetting mouldings are submitted to the fullest appropriate finishing operations.*

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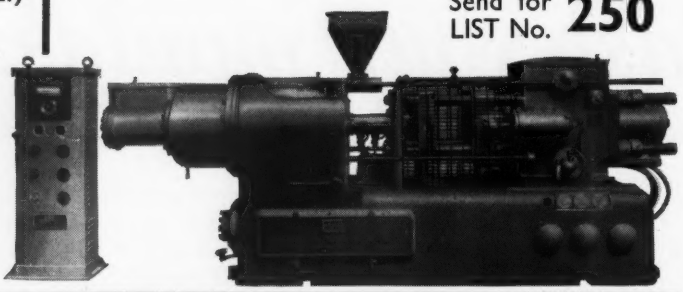

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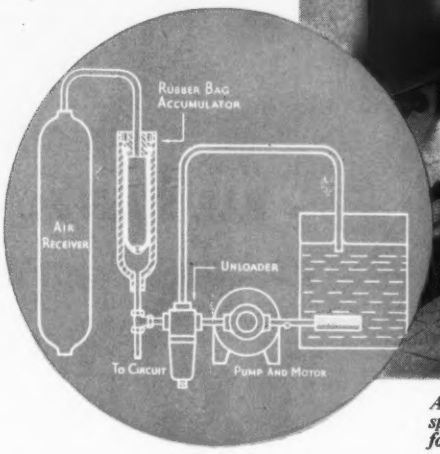
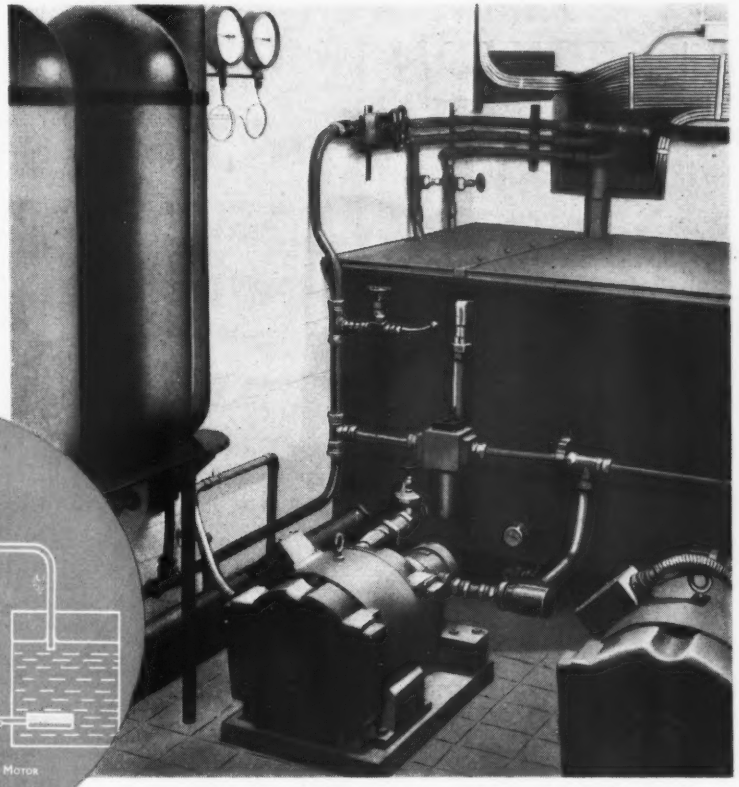
This medium-pressure-plus-intensifier system provides for the first time three pressures from a single source.



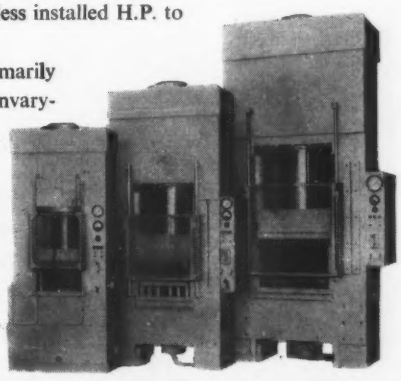


A typical BIPEL drive unit. This is one of four units installed in a single, space-saving underground chamber. A combination of any three of the four units can drive the forty presses installed.

The BIPEL drive system offers a combination of advantages that no other system can offer. It provides a compact, reliable source of hydraulic motive power, cheaper than any other to buy and operate. And, for the first time, it enables a down-stroking prefiller press to provide, from a single supply source, a choice of three moulding pressures at will — the initial line pressure followed by intensified pressures of two or three times that figure.

The maximum advantage is derived when the equipment is installed as a group drive feeding a number of presses, up to ten or twelve. Or, as a built-in unit operating a single press, it has many advantages over conventional high-pressure pumps; it still remains simpler and cheaper, requiring less installed H.P. to drive and retaining the feature of three operative pressures.

The BIPEL system, whilst also applicable to manually operated presses, is primarily designed for auto-control which enables the press to reproduce automatically with unvarying precision, any conceivable moulding cycle including dwelling and breathing.



BIPEL presses are made in three models, each affording three moulding pressures.

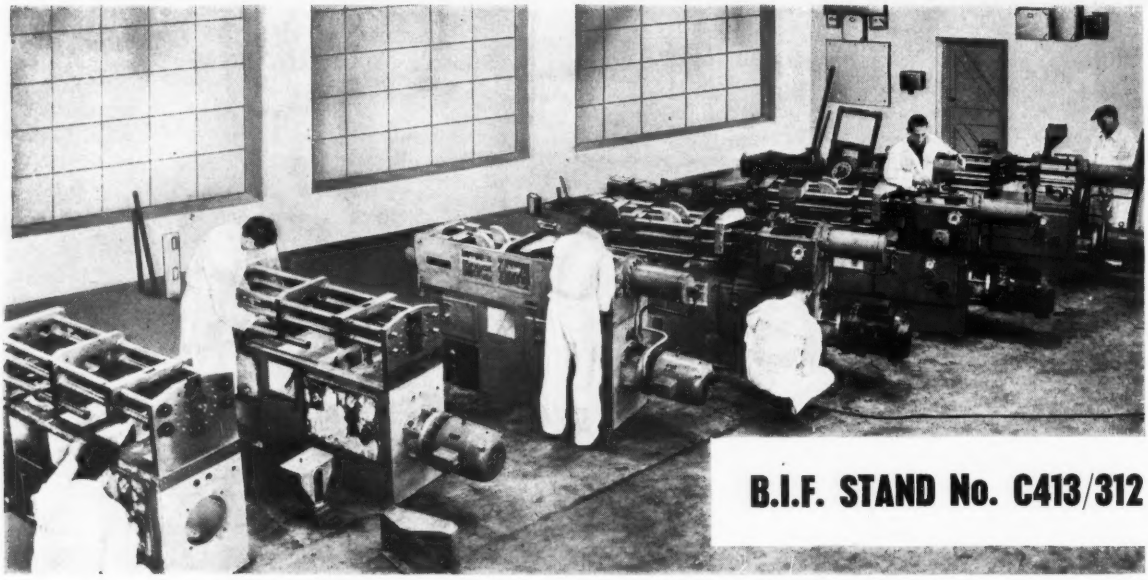
TYPE 40: 20, 40, 60 TONS
TYPE 100: 50, 100, 150 TONS
TYPE 200: 100, 200, 300 TONS

B.I.P GROUP

B.I.P. ENGINEERING LTD., ALDRIDGE ROAD, STREETLY, STAFFS.

Windsor

PRECISION BUILT PLASTIC MACHINES



B.I.F. STAND No. C413/312

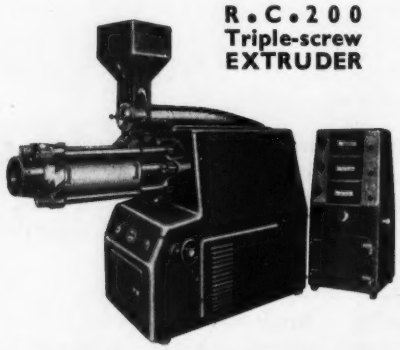
New Factory Extensions to meet World-wide Demand . .

To step up production in order to keep pace with delivery time schedules, R. H. Windsor Ltd. have just completed their new factory extensions at Chessington, Surrey, England.

The growing demand throughout the World for their famous R. C. Series of multi-screw Extruder Compounders is because, unlike ordinary extruders, all three (65 lbs., 100 lbs., and 200 lbs.) are able to perform four separate functions . . . compounding, extruding, colouring and reclaiming scrap.

The R. C. 65 and the R. C. 100 employ two interpenetrating screws, but the high capacity R. C. 200—which can simultaneously compound, colour and extrude at better than 200 pounds per hour—has three! Simple to operate—exceptionally versatile—low in operating costs and power consumption. Full details of each model sent on request.

R.C.200 Triple-screw EXTRUDER



The R. C. 200 will not only extrude 200 lbs. of material hourly, but will compound, pelletise, plasticise and colour all types of thermoplastic materials.

Manufactured under L·M·P· Patents

SERVING THE WORLD'S PLASTIC INDUSTRY — Windsor — PLASTIC MACHINES — TRADE MARK

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SEE OUR EXHIBIT

MOULDS, DIES ANCILLARY EQUIPMENT

It's always better to know!

— pity they can't move mountains quick enough to be of benefit to our two aviators! And speaking of radar, do you know that DERWENT precision mouldings are now used for quite a few radar components?

MINSTER MOULDINGS

get to know DERWENT

Derwent Plastics Ltd., Stamford Bridge, York. Tel: Stamford Bridge 294

n.d.h.370

Veneer making by peeling steamed log at Thames Plywood Manufacturers Limited

Vigilance is not enough

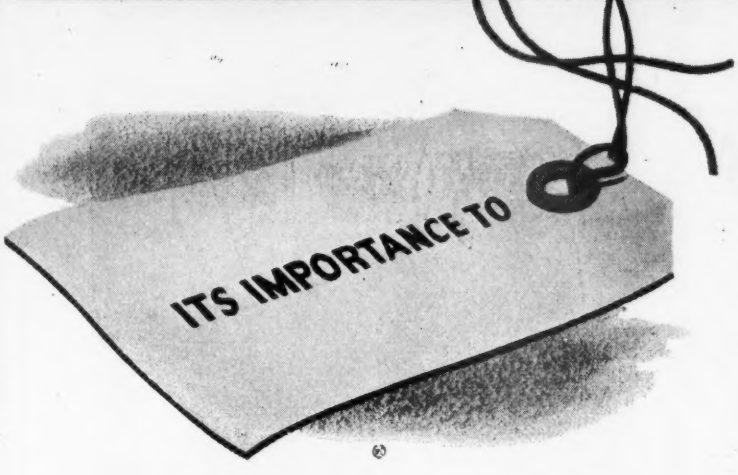
IN MACHINE PROCESSES which need constant care and attention, vigilance is useless without instant and complete control over the machine. Smooth, split-second control of all movements, and instant switch-off when things go wrong are essential to speedy, uniform production. Individual electric motors for each machine, with all controls convenient to one man's hands, achieve this end. Electricity used in this way is *electricity used efficiently for greater productivity.*

Electricity for PRODUCTIVITY

WHERE TO GET MORE INFORMATION

Your Electricity Board will be glad to help you to get the utmost value from the available power supply. They can advise you on ways to increase production by using Electricity to greater advantage — on methods which may save time and money, materials and coal, and help to reduce load shedding. Ask your Electricity Board for advice : it is at your disposal at any time.

Issued by the British Electrical Development Association



PLASTICS

THE business of both public and private enterprise could hardly pass along so smoothly without paper. Plastics, for instance, need base papers with the chemical and physical properties peculiar to the requirements of the industry. Rothmill plastic-base papers, produced by Tullis Russell, effectively supply this need. Full details of the range available will be forwarded on request.

Tullis Russell & Co. Ltd.

ESTABLISHED 1809

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BIRMINGHAM
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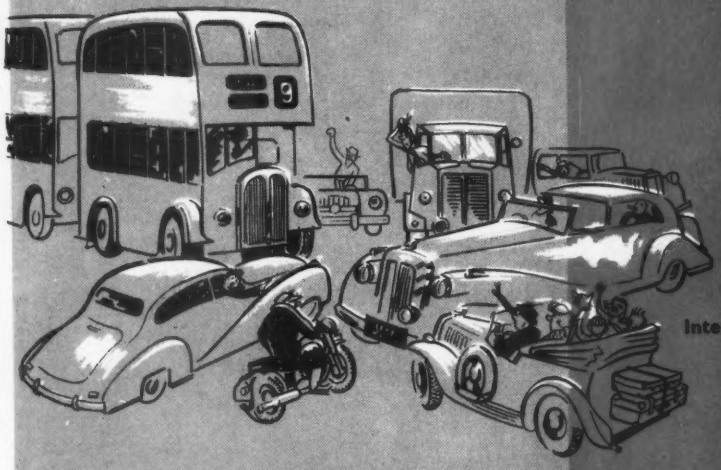
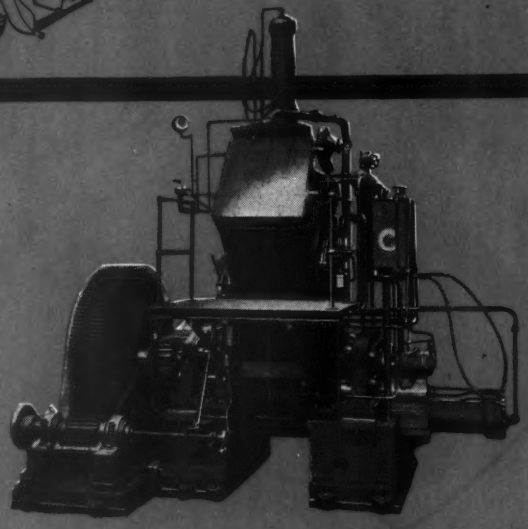
SCOTLAND
Auchmuty & Rothes Paper Mills
Markinch, Fife

INSULATING AND PLASTICS - BASE PAPER MAKERS

a really good mix up

In the middle of a traffic jam the other day, an interesting thought occurred. It is more than likely, we thought, that we had a hand in the production of the majority of the tyres, paint work, distributor caps and other plastic electrical components, bus drivers' buttons, the bitumen and asphalt and so on and so on. The list was unending. Interesting, but not entirely remarkable, when we considered that most people with problems of breaking down and mixing natural and synthetic rubbers and blending plastics, paint, asphalt, bitumen and many other materials used the Shaw Intermix enclosed type mixing machine.





SHAW

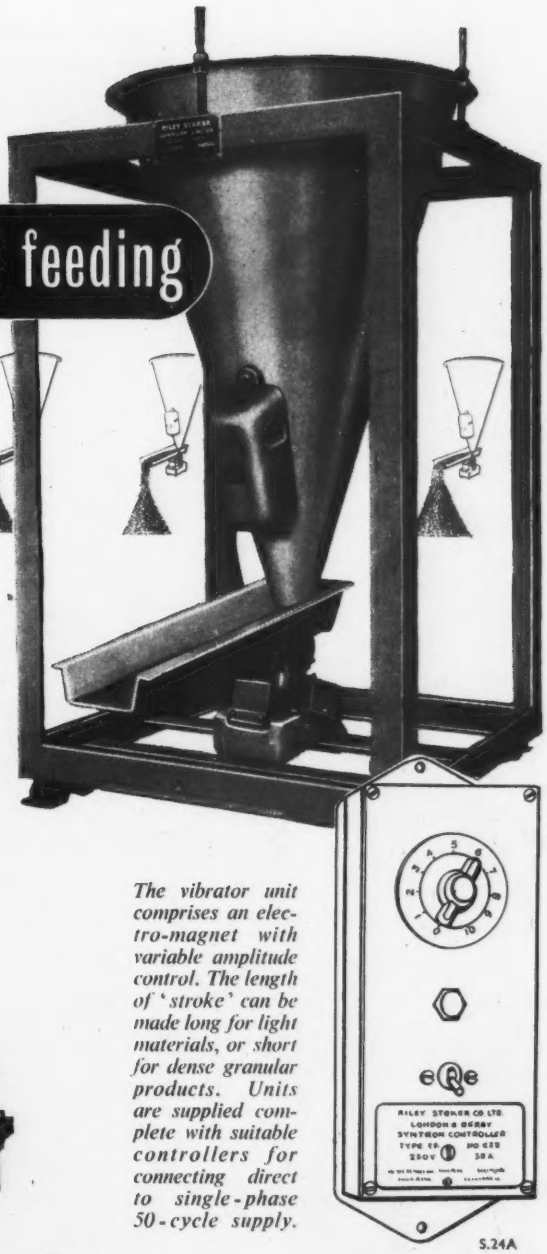
INTERNAL MIXERS

FRANCIS SHAW & CO LTD MANCHESTER II ENGLAND

BIF STAND NUMBER D417/516 BIRMINGHAM

SYNTRON

for steady CONTROLLABLE feeding



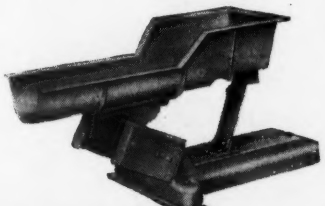
The Syntron Feeder Machine is a complete equipment, in which separate rheostat controls on vibrator and conveyor give an almost infinite flexibility at the touch of a knob. The noiseless vibrator fitted to the hopper prevents arching or bridging of the material, while adjustment of the height, angle and feed rate of the trough ensures continuous delivery at just the rate the plant requires.

The range of Syntron models includes vibrators to keep materials flowing, feeders to ensure steady delivery, and packers for filling or compacting.

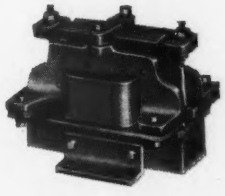
The vibrator unit comprises an electro-magnet with variable amplitude control. The length of 'stroke' can be made long for light materials, or short for dense granular products. Units are supplied complete with suitable controllers for connecting direct to single-phase 50-cycle supply.

S.24A

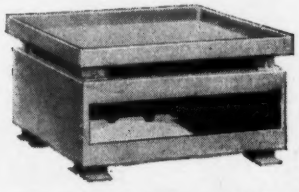
SYNTRON KEEPS THINGS MOVING



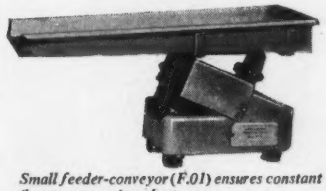
F.2 feeder-conveyor for controlled feeding to screens, pulverisers, weighing machines etc.



Medium duty vibrator, V.55, keeps materials running freely from bins, hoppers, chutes etc. Other sizes available.



Syntron Packers for economical filling of drums, cartons etc.; for mould and form shaking; for paper jogging.



Small feeder-conveyor (F.01) ensures constant flow to processing plant.

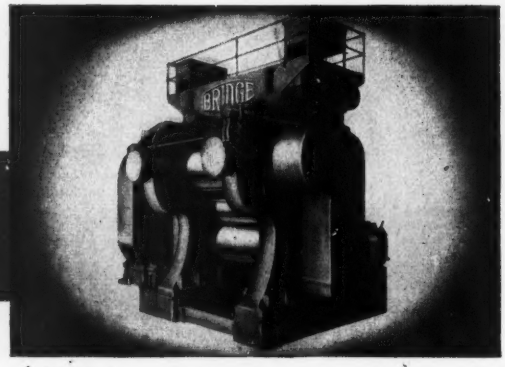
SYNTRON

ELECTRIC VIBRATORS & FEEDERS

Marketed for INTERNATIONAL COMBUSTION LIMITED by RILEY STOKER COMPANY LIMITED

NINETEEN WOBURN PLACE, LONDON, W.C.1 TERMINUS 2622

Precision Calender with three superimposed and one offset roller. Flood lubrication.



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The Hallmark

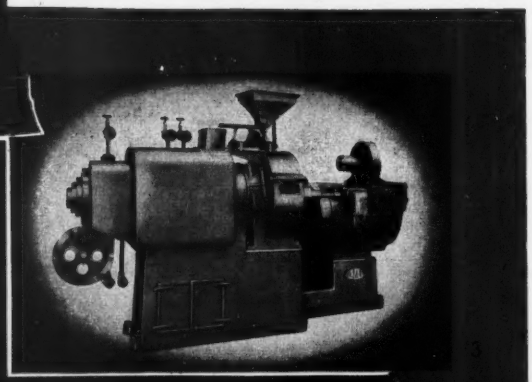
of DESIGN, SERVICE and PERFORMANCE *in* **RUBBER AND PLASTICS MACHINERY**

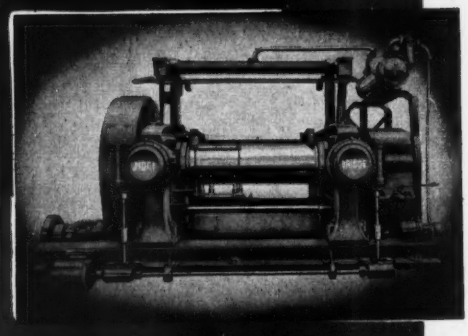
The Bridge — Banbury Patent Mixer. (1)

Precision Calender with four superimposed rollers. Flood lubrication. (2)

4½" Cold Feed Plastics Extruder. (3)

High temperature 22" x 60" Plastics Mill with flood lubrication. (4)





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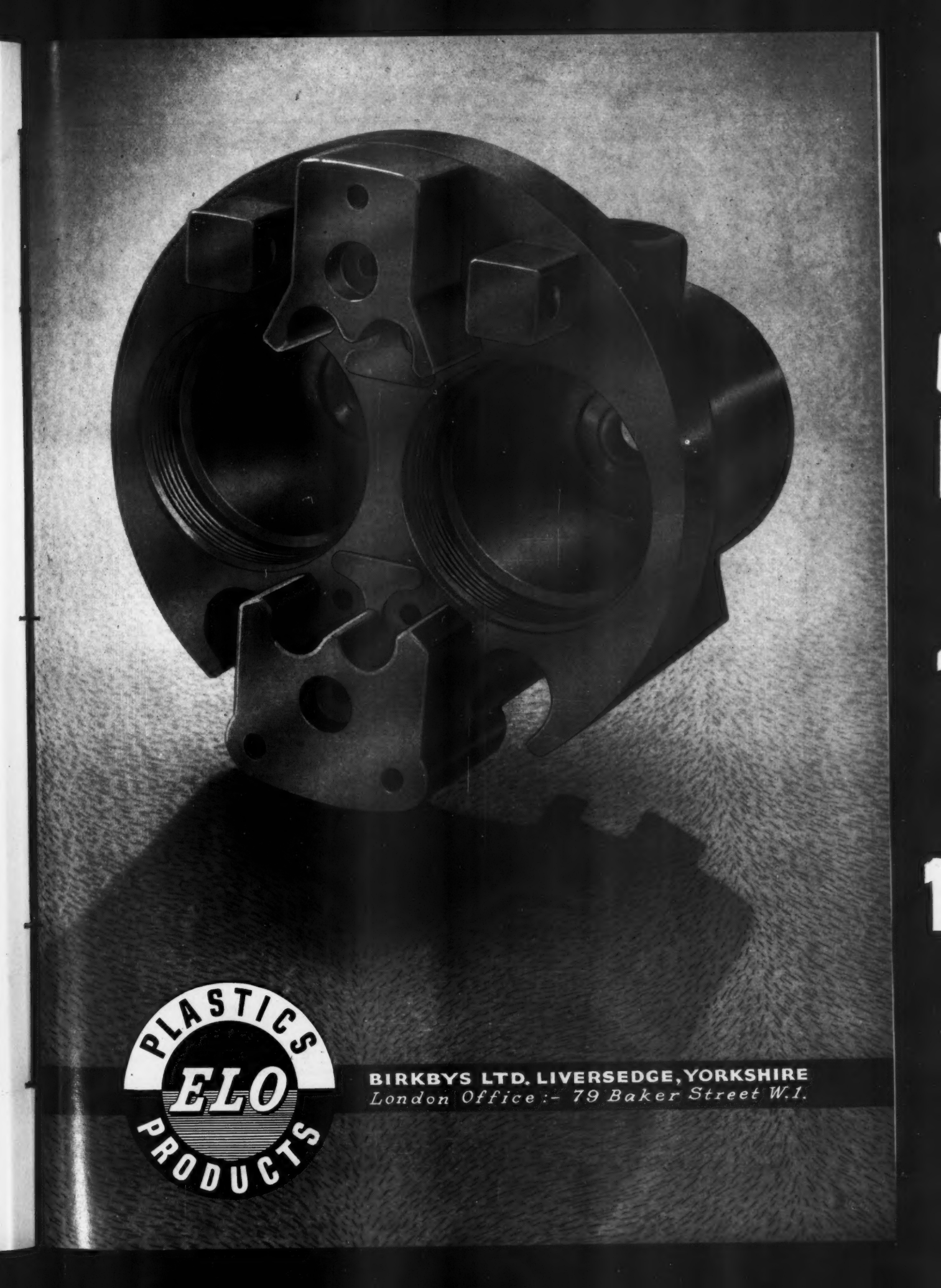
CASTLETON, ROCHDALE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ELO
PRODUCTS
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"TROVIDUR" (unplasticised) P.V.C., a *Constructional* material for chemical plants (pipe-lines, valves, stopcocks, etc.), laboratory and factory equipment—can effectively replace stainless steel for many purposes—completely resistant to a wide range of corrosive acids, etc., at temperatures of up to 60°C.

"DYNAGEN" ORG (Poly-iso-butylene) especially suitable for the lining of acid tanks of the largest capacity—and for temperatures up to 100°C.

"DYNAGEN" 7112—for the "proofing" of underground constructions of every type.

"ASTRALON" (Vinyl Co-polymer) available in CLEAR TRANSPARENT and all colours, resistant to corrosive gases, organic chemicals, vegetable and animal oils and fats —at temperatures up to 60°C.

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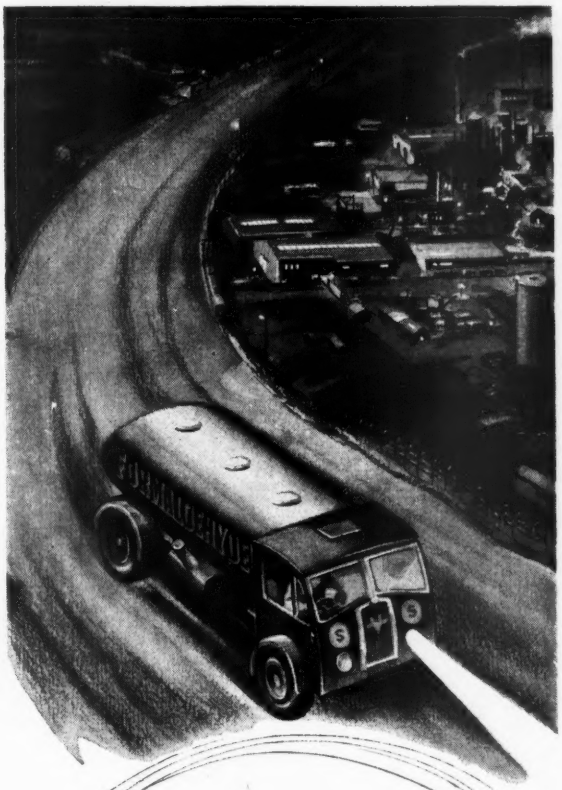

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An urgent order for Synthite Tested Formaldehyde, received an hour ago, is now aboard one of our powerful tankers and soon will be speeding through the darkness towards its destination.
Upholding once again the Synthite reputation for reliable service to the Plastics Industry of Great Britain.

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40% *by Volume*

Free from Deleterious Matter

FORMALDEHYDE 100% S Brand SYNTHITE LTD

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CELLULOSE NITRATE
(*Celluloid*)

CELLULOSE ACETATE
In sheets, clear transparent, white and black

LAMPSHADE AND OPTICAL CELLULOSE ACETATE SHEET
Full range

The above supplied in standard size sheets of 54" x 24" and in various thicknesses. Panels cut to required shapes by special arrangement

also

a range of 36 attractive colours in Cellulose Acetate
(10/1000" *thickness only*)

CELLULOSE ACETATE FILM
In clear transparent only

BX POLYSTYRENE
in sheets and rods

Enquiries for all types of thermoplastics welcomed

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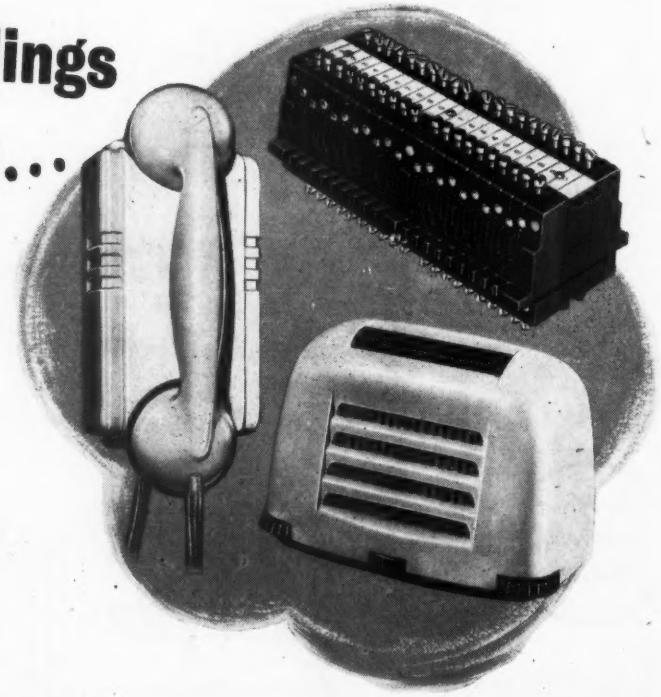
Precision mouldings for industry...



Somewhere in your production-line a high-grade, precision-moulded component can simplify assembly and make a cleaner, stronger, lighter and possibly less expensive job.
A **KENT MOULDINGS** engineer will be happy to examine any problem and give you sound and honest advice.

KM

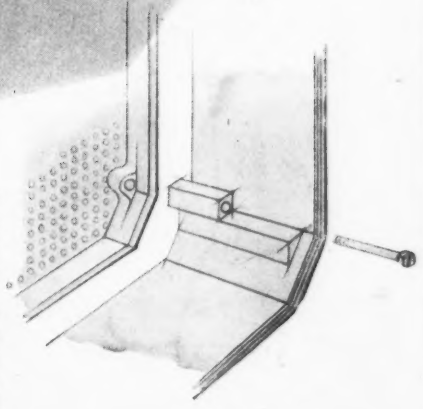
KENT MOULDINGS PROPRIETORS: HOLSTER BRANDES LIMITED

Makers of high-precision mouldings

Footscray, Sidcup, Kent FOOtscray 3333

Designer's Diary N.º 5

In this series the B.I.P. Product Design Unit seeks to illustrate how technical requirements can be met to produce pleasing, readily mouldable articles in plastics. Reprints of these announcements will be gladly supplied on request.



Diagrammatic details of method of fixing

The Product. Radio cabinets as a whole have tended to become rather stereotyped, as regards materials as well as form. There are, on the one hand, the beautifully veneered types, expensive to produce; and, on the other, self-coloured all-plastics moulded cabinets which generally follow rounded contours. These latter are also comparatively expensive because they involve a deep moulding and, consequently, somewhat high tooling costs. This design is an attempt to indicate how production costs could be lowered by using wood and plastics in combination, at the same time providing a pleasing and refreshing contrast in textures.

The Design. This cabinet is economical to produce because the wooden part is, in effect, simply a box without a base; one of the simplest of veneered forms, with a shallow, and therefore comparatively inexpensive, plastics front.

Amongst the main points of interest are the textured panel, which is incorporated as a loose piece in the mould and could, therefore, be interchanged if desired; and the knobs, of sculptured form to provide a positive fingerhold.

Assembly is extremely simple, the front being fixed to the body of the cabinet by four bolts through glued wooden blocks. Note that in the front elevation there is a small step between the body and front. This not only adds interest, but overcomes the difficulty always encountered in attempting to make a perfect butt-joint between wood and plastics.

The Material. Either Beetle or Scarab urea moulding powders are recommended for their fine texture, wide colour range and excellent electrical insulation properties.

The B.I.P. Technical Advisory Service is always ready to help moulders in any problem which may arise regarding product design, mould design, materials and moulding techniques. This consultative service is freely offered, without obligation, and applies to moulding in thermoplastic as well as thermosetting materials.

BRITISH INDUSTRIAL PLASTICS LIMITED, B·I·P GROUP **1 ARGYLL ST., LONDON, W.1.**

'BEETLE' and 'SCARAB' are trade marks registered in Great Britain and in most countries of the world

THE GATEWAY TO BETTER PLASTICS

Specialists in the manufacture of high-grade Thermoplastic materials.

RILMOLD Cellulose Acetate Moulding Powder.

RILENE fine P.V.C. sheeting, plain, embossed and patterned, including special non-inflammable grades.

RILPLATE Rigid mouldable plastic sheet, plain and metallic, for refrigerator and electrical industries. Ideal for tiling, panelling, etc.

DUREVER plastic floor covering.

RILCOM P.V.C. Compound. Extruding, Calendering and Cable Grades.

RILON heavy embossed unsupported P.V.C. leather cloth in a variety of grains.

RILPOL press polished sheeting, opaque, translucent, pastel and natural.

LEONEX SAFETY Conveyor Belting.

RILFOIL metallic-like plastic leaf foil for all trades.

All types of non-inflammable P.V.C. mechanical mouldings and laminates.

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Head Office: **LEONEX WORKS, Hythe Road, Willesden, London, N.W.10**

Tel.: LADbroke 2454 *Grams:* "Rubberland Harles, London"

Factory: Rilex Works, London Road, Wellingborough *Tel.:* Wellingborough 2218 *Grams:* "Rilex, Wellingborough"

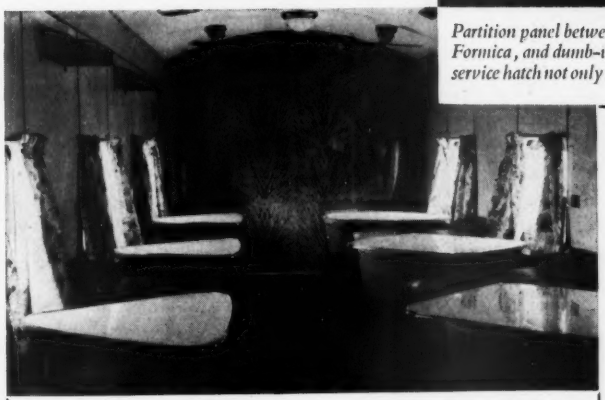
Manchester Office: 22 Upper Camp Street, Broughton, Salford, 7 *Tel.:* Manchester Broughton 1549

MINISTRY AND A.I.D. APPROVED

IT'S SURFACE WITH A SMILE ON PAKISTAN RAILWAYS

PAKISTAN newspapers made a big feature of the North Western Railway's new first-class carriages for the Karachi-Lahore run, and gave their Formica fittings special mention. Over a hundred new coaches have Formica wall panels and partitions; the dining cars also have Formica table-tops and ingenious dumb-waiters faced with this tough, smooth wear-resistant, stain-resistant, laminated plastic. A first-class amenity—and a first-class investment, this surface with a smile!

Partition panel between Dining Car and Kitchen surfaced in Cherry Mahogany Wood Grain Formica, and dumb-waiter surfaced in Bleached Mahogany Wood Grain Formica. This novel service hatch not only speeds up service, but keeps kitchen smells and noises from the Dining Car.



Dining car walls are in Bleached Mahogany Wood Grain Formica; partition panels in Cherry Mahogany Wood Grain Formica; table-tops of Cigarette-proof (C.P.) Linette Formica.

FIRST COST IS LAST COST—No renewals, negligible maintenance. The saving in cleaners' time and materials alone is impressive.

TOUGH AS STEEL and hard as glass, but 'warm' to the touch. Won't crack, won't craze, won't wear—ever. Repels attack by vermin, white ants, termites, etc.

EASY TO CLEAN—A wipe with a damp cloth keeps it gleaming. Its hard, non-porous surface cannot hold dirt or germs.

RESISTS HEAT—Unaffected by temperatures up to 130°C (266°F). Cigarette-proof grade cannot be damaged by burning cigarettes.

GOOD TO LOOK AT ALWAYS—Impervious to normal acids and alkalis, alcohol, oils, drinks and foods of all kinds. Wide range of cheerful, permanent colours and textures. Does not encourage condensation.

FORMICA REGD. MADE BY DE LA RUE

PUTS YOU YEARS AHEAD

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SYNTHETIC RESINS
CRESYLIC and PHENOLIC
LAMINATING, PAINT
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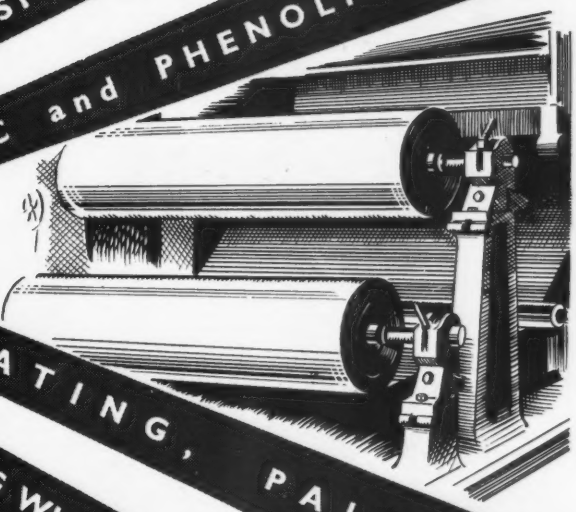

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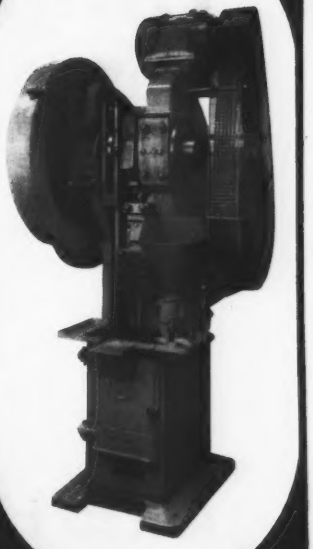

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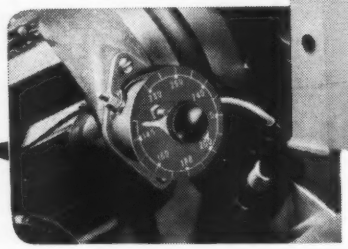

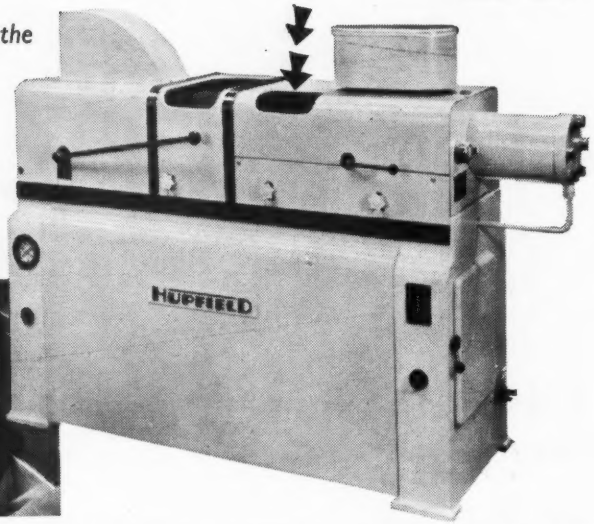

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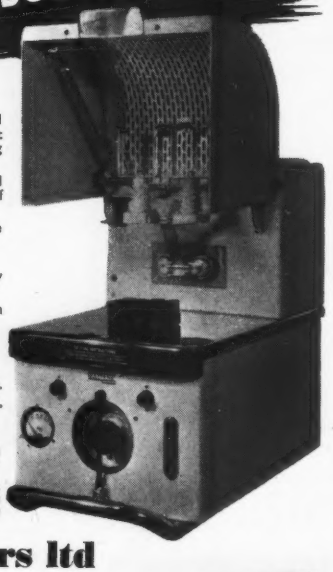

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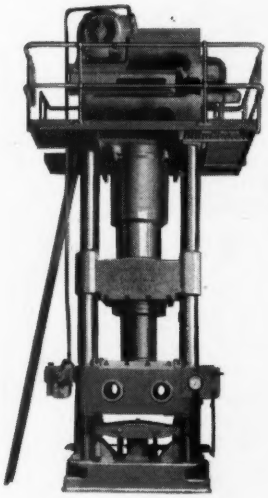

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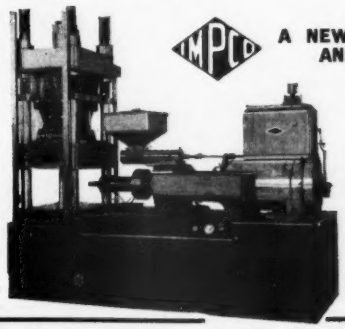

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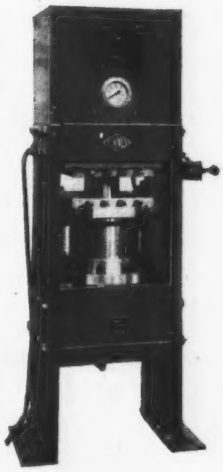

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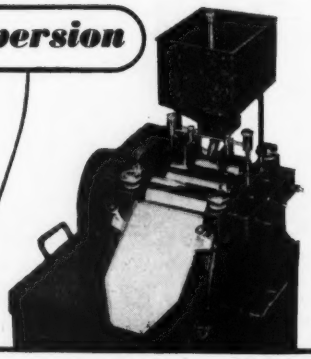

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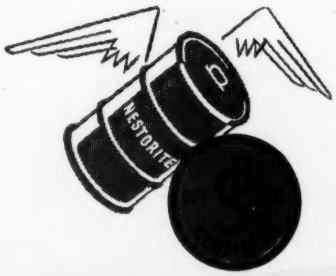

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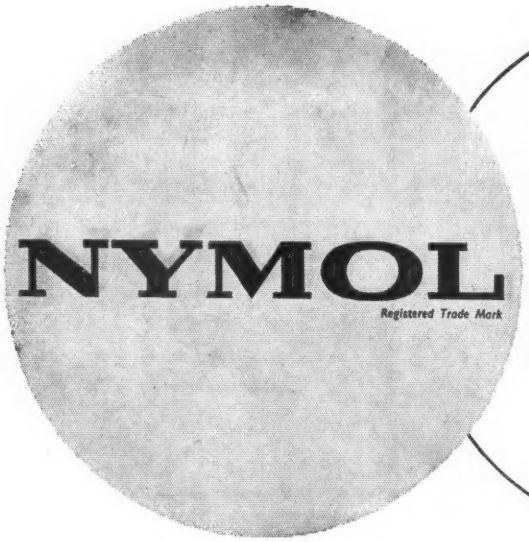

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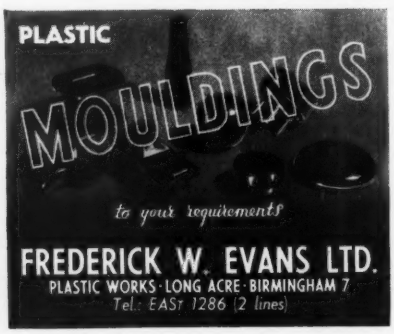

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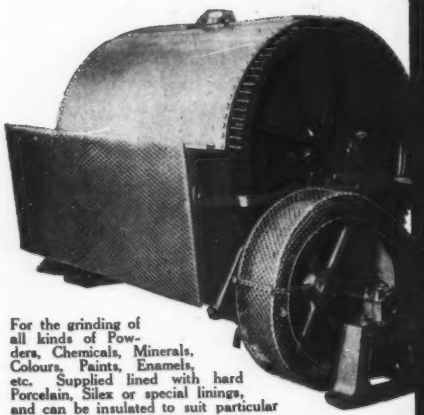

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